

# **VAX 4000 Model 400/500/600 Technical Information**

**Order Number EK-452AD-TI.004**

**Digital Equipment Corporation  
Maynard, Massachusetts**

---

**First Printing, December 1991**  
**Revised, February 1992**  
**Revised, April 1992**  
**Revised, July 1992**

The information in this document is subject to change without notice and should not be construed as a commitment by Digital Equipment Corporation.

Digital Equipment Corporation assumes no responsibility for any errors that may appear in this document.

The software, if any, described in this document is furnished under a license and may be used or copied only in accordance with the terms of such license. No responsibility is assumed for the use or reliability of software or equipment that is not supplied by Digital Equipment Corporation or its affiliated companies.

**Restricted Rights:** Use, duplication or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013.

Copyright © Digital Equipment Corporation 1991, 1992. All Rights Reserved.

The Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

The following are trademarks of Digital Equipment Corporation: CompacTape, CX, DDCCMP, DEC, DECconnect, DECdirect, DECnet, DECscan, DECserver, DECUS, DECwindows, DELNI, DEMPR, DESQA, DESTA, DSRVB, DSSI, IVAX, KDA, KLESI, MicroVAX, MSCP, Q-bus, Q22-bus, RA, RQDX, RV20, SA, SDI, ThinWire, TK, TMSCP, TQK, TS05, TU, VAX, VAX 4000, VAXcluster, VAX DOCUMENT, VAXELN, VAXlab, VAXserver, VMS, VT, and the DIGITAL logo.

**FCC NOTICE:** The equipment described in this manual generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference.

Operation of the equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

S1979

This document was prepared using VAX DOCUMENT, Version 2.1.

# Contents

---

## Preface

vii

## Chapter 1 Base System Description

---

1.1	System Overview .....	1-1
1.2	Firmware Overview .....	1-2
1.3	Power-Up .....	1-3
1.4	Console I/O Mode Overview .....	1-3
1.4.1	Control Characters in Console I/O Mode .....	1-4
1.4.2	Console I/O Mode Commands .....	1-6
1.5	Digital Storage Systems Interconnect (DSSI) .....	1-11
1.6	KA675-AA CPU Specifications .....	1-12
1.7	KA680-AA CPU Specifications .....	1-15
1.8	KA690-AA CPU Specifications .....	1-19
1.9	MS690 Memory Specifications .....	1-23

## Chapter 2 Option Specifications

---

2.1	Options Overview .....	2-1
2.1.1	Configuration .....	2-1
2.2	Mass Storage Options .....	2-2
2.2.1	KDA50 Controller .....	2-2
2.2.2	KFQSA Storage Adapter .....	2-4
2.2.3	KLESI Controller .....	2-5
2.2.4	KZQSA Storage Adapter .....	2-5
2.2.5	RA60 Disk Drive .....	2-6
2.2.6	RA70E Disk Drive .....	2-7
2.2.7	RA81 Disk Drive .....	2-8
2.2.8	RA82 Disk Drive .....	2-10
2.2.9	RA90 Disk Drive .....	2-11



2.2.10	RA92 Disk Drive .....	2-12
2.2.11	RF31 Integrated Storage Element (ISE) .....	2-13
2.2.12	RF31F Integrated Storage Element .....	2-14
2.2.13	RF35 Integrated Storage Element .....	2-15
2.2.14	RF71 Integrated Storage Element (ISE) .....	2-17
2.2.15	RF72 Integrated Storage Element (ISE) .....	2-18
2.2.16	RF73 Integrated Storage Element (ISE) .....	2-19
2.2.17	RRD40 Compact-Disc Subsystem .....	2-21
2.2.18	RRD42 Optical Compact-Disc Subsystem .....	2-22
2.2.19	TF85 Tape Drive .....	2-23
2.2.20	TK50 Tape Drive .....	2-25
2.2.21	TK70 Tape Drive .....	2-26
2.2.22	TLZ04 Tape Drive .....	2-28
2.2.23	TSZ07 Tape Drive .....	2-30
2.2.24	TSV05 Tape Drive .....	2-32
2.2.25	TSV05 Controller .....	2-33
2.2.26	TU81-Plus Tape Drive .....	2-34
2.3	Communication Options .....	2-35
2.3.1	CXA16 Asynchronous Multiplexer (16 lines) .....	2-36
2.3.2	CXB16 Asynchronous Multiplexer (16 lines) .....	2-38
2.3.3	CXY08 Asynchronous Multiplexer (8 Lines) .....	2-41
2.3.4	DEQRA Token Ring Q-Bus Adapter .....	2-43
2.3.5	DESQL Ethernet Controller .....	2-44
2.3.6	DFA01 Asynchronous Controller with Integral Modem ...	2-45
2.3.7	DPV11 Synchronous Controller .....	2-47
2.3.8	DSRVB DECserver 200 .....	2-48
2.3.9	DSV11 Synchronous Controller .....	2-49
2.4	Real-Time Options .....	2-50
2.4.1	AAV11-S Digital-to-Analog Converter .....	2-51
2.4.2	ADQ32 Analog-to-Digital Converter .....	2-52
2.4.3	ADV11-S Analog-to-Digital Converter .....	2-55
2.4.4	AXV11 Controller .....	2-57
2.4.5	DIV32 Controller .....	2-59
2.4.6	DRQ3B Parallel Interface .....	2-60
2.4.7	DRV1W Parallel Interface .....	2-61
2.4.8	IBQ01 Controller .....	2-63



2.4.9	IEQ11 Controller .....	2-64
2.4.10	KWV11-S Programmable Real-Time Clock .....	2-65
2.5	Printer Interface .....	2-68
2.5.1	LPV11-SA Printer Interface .....	2-68
2.6	Graphics Adapter .....	2-68
2.6.1	VS30U Graphics Adapter .....	2-68

## Chapter 3 System Expansion

---

3.1	Planning System Expansion .....	3-1
3.2	Completing the System Configuration Worksheet .....	3-2

## Index

---

### Tables

---

1-1	Console I/O Mode Control Characters .....	1-4
1-2	Console I/O Mode Commands .....	1-6
1-3	Device Names .....	1-10
3-1	Power Requirements .....	3-4

1. The first part of the report is a general introduction to the subject of the study. It discusses the importance of the study and the objectives of the research. It also provides a brief overview of the methodology used in the study.

2. The second part of the report is a detailed description of the study area. It includes information about the location of the study area, the population of the study area, and the characteristics of the study area. It also discusses the data sources used in the study.

3. The third part of the report is a description of the methodology used in the study. It includes information about the research design, the data collection methods, and the data analysis methods. It also discusses the limitations of the study.

4. The fourth part of the report is a description of the results of the study. It includes information about the findings of the study, the conclusions drawn from the findings, and the implications of the findings. It also discusses the strengths and weaknesses of the study.

5. The fifth part of the report is a conclusion. It summarizes the findings of the study and provides a final statement about the study.

6. The sixth part of the report is a list of references. It includes information about the sources of information used in the study.

7. The seventh part of the report is an appendix. It includes information about the data used in the study.

8. The eighth part of the report is a glossary. It includes information about the terms used in the study.

9. The ninth part of the report is a list of figures. It includes information about the figures used in the study.

10. The tenth part of the report is a list of tables. It includes information about the tables used in the study.

11. The eleventh part of the report is a list of abbreviations. It includes information about the abbreviations used in the study.

12. The twelfth part of the report is a list of acronyms. It includes information about the acronyms used in the study.

13. The thirteenth part of the report is a list of symbols. It includes information about the symbols used in the study.

14. The fourteenth part of the report is a list of units. It includes information about the units used in the study.

15. The fifteenth part of the report is a list of definitions. It includes information about the definitions used in the study.

## Preface

---

This manual provides a summary of technical information for your system. The manual is organized as follows.

- Chapter 1 describes the base system and lists specifications for the CPUs and the memory modules.
- Chapter 2 describes optional components available for your system and lists their specifications.
- Chapter 3 provides guidelines on how to expand your system.

**NOTE:** *You will find a glossary in the Operation manual to help with word definitions and acronyms.*

The following conventions are used in this manual.

Convention	Meaning
<b>Key</b>	A terminal key used in text and examples. For example, <b>Break</b> indicates that you press the Break key on your terminal keyboard.
<b>Ctrl/x</b>	Hold down the Ctrl key while you press another key.
<b>BOLD</b>	Your input. For example:  >>> <b>BOOT MIA5</b>  shows that you must enter <b>BOOT MIA5</b> at the console prompt.
<b>NOTE</b>	Provides general information about the current topic.



1947

... ..  
... ..  
... ..  
... ..  
... ..

... ..  
... ..  
... ..

... ..  
... ..  
... ..

... ..  
... ..  
... ..

... ..  
... ..  
... ..

... ..  
... ..  
... ..

... ..  
... ..  
... ..

... ..  
... ..  
... ..

... ..  
... ..  
... ..

# Chapter 1

## Base System Description

---

This chapter describes the base system, including the following.

- Power-up self-tests
- Digital Storage Systems Interconnect (DSSI) architecture
- Specifications for the KA6nn-AA CPU, and the MS690-BA/-CA/-DA memory modules.

### 1.1 System Overview

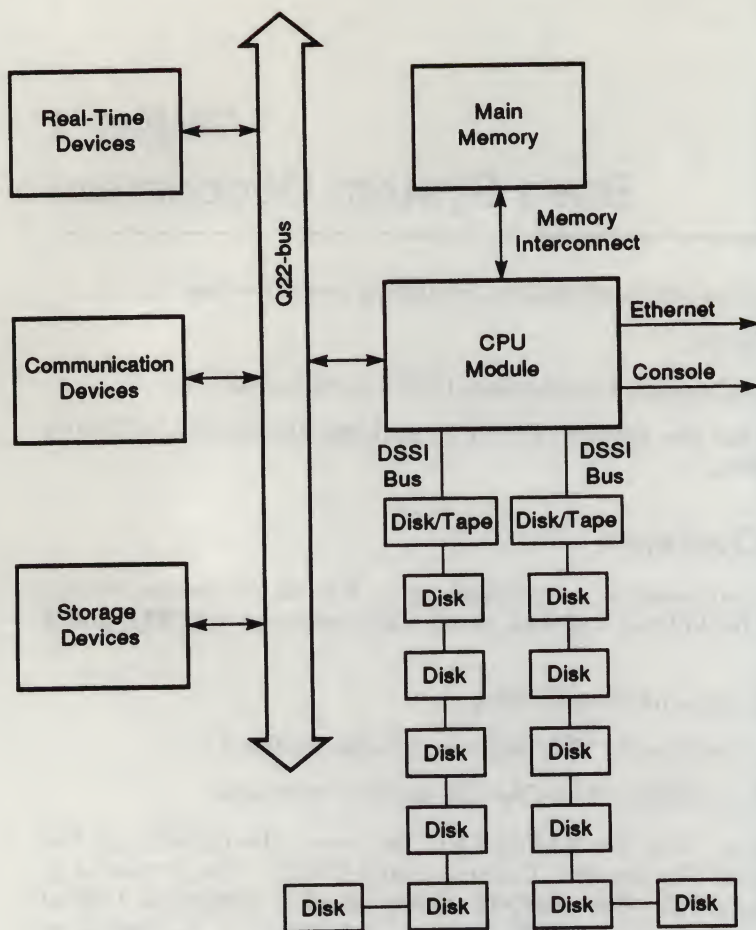
All base system components are housed in a BA440 enclosure, which contains a 12-slot backplane, 7 Q-bus slots; 1 slot reserved for CPU, and 4 slots for memory.

Each base system contains the following.

- A KA6nn-AA (L4002-nA) CPU module, located in slot 5.
- From one to four MS690-BA/-CA/-DA memory modules.

The system operates from the KA6nn CPU firmware, the controls on the console module, and the System Control Panel (SCP). The firmware is described in Section 1.2. Base system operation also integrates Digital Storage Systems Interconnect (DSSI) technology, which is discussed in Section 1.5.

A block diagram of the system:



MLO-007192

## 1.2 Firmware Overview

Four flash-eraseable programmable read-only memory (FEPROM) chips on the KA6nn CPU module contain the firmware. This firmware consists of the following three major programs, which perform the system power-up self-tests and diagnostics.

- A console program
- A set of self-tests for the CPU and memory



- A primary bootstrap program (VMB)

The console program receives control whenever the processor halts. In a processor halt, processor control passes to the console program and instruction execution continues.

Control passes to the firmware under any of the following conditions.

- You turn on the system.
- You press the Restart button.
- You assert the Q22-bus BHALT signal by pressing the Halt button.
- You enter a break when the Break Enable/Disable switch is set to enable.
- A HALT instruction is executed.
- A system error occurs.

## 1.3 Power-Up

At power-up, the console program determines the console device type and console language, then runs the self-tests for the CPU and memory. You choose the console language when you perform the set-up operations during your console terminal installation procedure.

You determine the type of power-up mode by setting the Power-Up Mode switch on the CPU console module. See your *Operation* manual for the following power-up information.

- Power-up procedures
- Power-Up Mode and Break Enable/Disable switch settings
- Examples of successful power-up sequences
- Boot and autoboot procedures

See your *Troubleshooting and Diagnostics* manual for examples of problems you may encounter during power-up.

## 1.4 Console I/O Mode Overview

If you set the Break Enable/Disable switch on the console module to enable, the console program enters Console I/O mode after the power-up self-tests are completed successfully. The console program also enters Console I/O mode in response to any external halt condition.

Console I/O mode allows you to control the system by typing commands at the console prompt (>>>). You may enter these commands in either uppercase or lowercase letters. Enter each command, then press **Return**.

### 1.4.1 Control Characters in Console I/O Mode

Table 1-1 lists the keypad control characters that have special meaning in Console I/O mode.

**Table 1-1: Console I/O Mode Control Characters**

Character	Action
<b>Return</b> also <CR>	The carriage return ends a command line. No action is taken on a command until after it is terminated by a carriage return. A null line terminated by a carriage return is treated as a valid, null command. No action is taken, and the console prompts for input. Carriage return is echoed as carriage return, line feed <CR><LF>.
<X> (rubout)	When you press <X> (rubout), the console deletes the previously typed character. The resulting display differs, depending on whether the console is a video or a hardcopy terminal.

**For hardcopy terminals**, the console echoes a backslash (\) followed by the character being deleted. If you press additional rubouts, the additional deleted characters are echoed. If you type a non-rubout character, the console echoes another backslash, followed by the character typed. The result is to echo the characters deleted, surrounding them with backslashes. For example:

```
EXAMI;E<X> (rubout)<X> (rubout)NE <CR>
```

The console echoes: EXAMI;E\E\;NE<CR>

The console sees the command line: EXAMINE<CR>

**For video terminals**, the previous character is erased and the cursor is restored to its previous position.

The console does not delete characters past the beginning of a command line. If you press more rubouts than there are characters on the line, the extra rubouts are ignored. A rubout entered on a blank line is ignored.)

<b>Ctrl/A</b> or <b>F14</b>	Toggles insertion/overstrike mode for command line editing. By default, the console powers up to overstrike mode.
-----------------------------	---

<b>Ctrl/C</b>	Echoes ^C<CR> and aborts processing of a command. Has no effect as part of a binary load data stream. Clears <b>Ctrl/S</b> and re-enables output stopped by <b>Ctrl/O</b> .
---------------	---

<b>Ctrl/D</b> or <b>←</b>	Moves the cursor one position to the left.
---------------------------	--



**Table 1-1 (Cont.): Console I/O Mode Control Characters**

Character	Action
<b>Ctrl/E</b>	Moves the cursor to the end of the line.
<b>Ctrl/F</b> or <b>→</b>	Moves the cursor one position to the right.
<b>Ctrl/B</b> , <b>↑</b> , or <b>↓</b>	Recalls the previous commands.
<b>Ctrl/H</b> , <b>←X</b> (rubout), or <b>F12</b>	Deletes the previously typed character. Same function as <b>←X</b> (rubout), above.
<b>Ctrl/O</b>	Ignores transmissions to the console until you enter <b>Ctrl/O</b> . Echoes ^O when disabling output, which is not echoed when it re-enables output. Output is re-enabled if the console prints an error message, or if it prompts for a command from the terminal. Output is also enabled by entering Maintenance mode: press <b>Break</b> or enter <b>Ctrl/C</b> .
<b>Ctrl/Q</b>	Resumes output to the console terminal. Not echoed.
<b>Ctrl/R</b>	Echoes <CR><LF>, followed by the current command line. Can be used to improve the readability of a command line that has been heavily edited.
<b>Ctrl/S</b>	Stops output to the console terminal until you enter <b>Ctrl/Q</b> . Not echoed.
<b>Ctrl/U</b>	Echoes ^U<CR>. Entered, but otherwise ignored if typed on an empty line.

The console accepts Console I/O mode commands up to 80-characters long. Longer commands produce error messages. The character count does not include rubouts, rubbed-out characters, or the <CR> at the end of the command.

Two or more consecutive spaces and tabs are treated as a single space. Leading and trailing spaces and tabs are ignored. You can place command qualifiers after the command keyword or after any symbol or number in the command.

All numbers (addresses, data, counts) are hexadecimal, but symbolic register names contain decimal register numbers. The hexadecimal digits are 0 through 9, and A through F. You can use uppercase and lowercase letters in hexadecimal numbers (A through F) and commands.

The following symbols are qualifier and argument conventions.

- [ ] = an optional qualifier or argument
- { } = a required qualifier or argument



## 1.4.2 Console I/O Mode Commands

Table 1-2 lists and describes the Console I/O mode commands. You can display the list of commands by entering **HELP** at the console prompt (**>>>**).

**Table 1-2: Console I/O Mode Commands**

Command	Action
BOOT	Initializes the processor and transfers execution to the VMB.
CONFIGURE	Invokes an interactive mode that permits you to enter Q22-bus device names, then generates a table of Q22-bus I/O page device CSR addresses and interrupt vectors.
CONTINUE	Causes the processor to resume instruction execution at the point where the halt occurred. Does not perform a processor initialization.
DEPOSIT	Deposits data into the address you specify. If you do not specify an address space or data size qualifier, the console uses the last address space and data size used in a DEPOSIT, EXAMINE, MOVE, or SEARCH command.
EXAMINE	Examines the contents of the memory location or register of the address you specify.
FIND	Searches main memory starting at address 0 (zero) for a page-aligned 128-Kbyte segment of good memory, or a restart parameter block (RPB).
HALT	The HALT command has no effect. It is included for compatibility with other VAX consoles.
HELP	Displays the correct syntax for all console commands.
INITIALIZE	Performs a processor initialization.
MOVE	Copies the block of memory starting at the source address to a block beginning at the destination address.
NEXT	Executes the number of macro instructions you specify. If you do not specify a number, 1 (one) is assumed.
REPEAT	Repeatedly displays and executes the command you specify. Press <b>Ctrl-C</b> to stop the command. You can specify any valid console command except the REPEAT command.
SEARCH	Finds all occurrences of a pattern and reports the addresses where the pattern was found. If you include the /NOT qualifier, the command reports all addresses for which the pattern did not match.
SET BFLAG	Sets the default R5 boot flags. The value must be a hexadecimal number of up to eight digits.

**Table 1-2 (Cont.): Console I/O Mode Commands**

<b>Command</b>	<b>Action</b>
SET BOOT	Sets the default boot device. The value must be a valid device name.
SET CONTROLP	Sets Control-P as the console halt condition, instead of a BREAK.
SET HOST	Connects to the DUP or MAINTENANCE driver on the node or device you specify.
SET LANGUAGE	Sets the console language and keyboard type.
SET HALT	Sets the halt action you define. Acceptable values are the keywords: default, restart, reboot, halt, restart_reboot, or a number in the range 0 to 4 inclusive.
SET RECALL	Sets command recall state to either ENABLED (1) or DISABLED (0).
SHOW BFLAG	Displays the default R5 boot flags.
SHOW BOOT	Displays the default boot device.
SHOW CONTROLP	Shows the current state of Control-P halt recognition, either ENABLED or DISABLED.
SHOW DEVICE	Displays all devices displayed by the SHOW DSSI, SHOW ETHERNET, and SHOW UQSSP commands.
SHOW DSSI	Displays the status of all nodes that can be found on the DSSI bus. For each node on the DSSI bus, the firmware displays the node number, the node name, and the boot name and type of the device, if available. Does not indicate whether the device contains a bootable image.
SHOW ETHERNET	Displays the hardware Ethernet address for all Ethernet adapters that can be found, both on-board and on the Q22-bus.
SHOW LANGUAGE	Displays console language and keyboard type.
SHOW MEMORY	Displays main memory configuration, board by board.
SHOW QBUS	Displays all Q22-bus I/O addresses that respond to an aligned word read, plus vector and device name information. For each address, the console displays the address in the VAX I/O space in hexadecimal, the address as it would appear in the Q22-bus I/O space in octal, and the word that was read in hexadecimal. Also displays the vector that you should set up, and device name or names that could be associated with the CSR.
SHOW RECALL	Displays the current state of command recall, either ENABLED or DISABLED.



**Table 1-2 (Cont.): Console I/O Mode Commands**

<b>Command</b>	<b>Action</b>
SHOW HALT	Displays the halt action. Keywords include: default, restart, reboot, halt, restart_reboot or a number in the range 0 to 4 inclusive.
SHOW RLV12	Displays all RL01 and RL02 disks that appear on the Q22-bus.
SHOW SCSI	Shows any SCSI devices in the system.
SHOW TRANSLATION	Shows any virtual addresses that map to the specified physical address.
SHOW UQSSP	Displays the status of all disks and tapes that can be found on the Q22-bus that support the UQSSP protocol. For each such disk or tape on the Q22-bus, the firmware displays the controller number, the controller CSR address, and the boot name and type of each device connected to the controller. The command does not indicate whether the device contains a bootable image.
SHOW VERSION	Displays the current firmware version.
START	Starts instruction execution at the address you specify. If you do not give an address, the current program counter is used. If memory mapping is enabled, macro instructions are executed from virtual memory, and the address is treated as a virtual address. Equivalent to a DEPOSIT to PC, followed by a CONTINUE. Does not perform a processor initialization.
TEST	Invokes a diagnostic test program specified by the test number you enter. If you enter a test number of 0 (zero), all tests allowed to be executed from the console terminal are executed. The console accepts an optional list of up to five additional hexadecimal arguments.
UNJAM	Performs an I/O bus reset, by writing a 1 (one) to IPR 55 (decimal).
X	Loads or unloads (that is, writes to memory or reads from memory) the specified number of data bytes through the console serial line (regardless of console type), starting at the specified address. For use by automatic systems communicating with the console.

The following examples show sample displays for the commonly used commands SHOW and SET.

The SET command sets the parameter to the value you specify. The SHOW command displays the console parameter you specify.



**>>> SHOW QBUS**

Scan of Qbus I/O Space

-20001920 (774440) = FF08 DELQA/DESQA  
-20001922 (774442) = FF00  
-20001924 (774444) = FF2B  
-20001926 (774446) = FF08  
-20001928 (774450) = FFD7  
-2000192A (774452) = FF41  
-2000192C (774454) = 0000  
-2000192E (774456) = 1030  
-20001F40 (777500) = 0020 IPCR

Scan of Qbus Memory Space

>>>

For each address, the console displays the address in the VAX I/O space in hexadecimal, the address as it would appear in the Q22-bus I/O space in octal, and the word data that was read in hexadecimal.

**>>>SHOW DEVICE**

DSSI Bus 0 Node 0 (SYSDSK)

-DIA10 (RF31)

DSSI Bus 0 Node 1 (R7EB3C)

-DIA11 (RF31)

DSSI Bus 0 Node 2 (R7EB22)

-DIA12 (RF31)

DSSI Bus 0 Node 5 (TFDR1)

-MIA5 (TF85)

DSSI Bus 0 Node 6 (\*)

DSSI Bus 1 Node 0 (SNEEZY)

-DIB0 (RF71)

DSSI Bus 1 Node 1 (DOPEY)

-DIB1 (RF71)

DSSI Bus 1 Node 2 (SLEEPY)

-DIB2 (RF71)

DSSI Bus 1 Node 3 (GRUMPY)

-DIB3 (RF71)

DSSI Bus 1 Node 4 (BASHFUL)

-DIB4 (RF71)

DSSI Bus 1 Node 5 (HAPPY)

-DIB5 (RF71)

DSSI Bus 1 Node 6 (DOC)

-DIB6 (RF71)

DSSI Bus 1 Node 7 (\*)

UQSSP Tape Controller 0 (774500)

-MUA0 (TK70)

Ethernet Adapter

-EZA0 (08-00-2B-06-10-42)

For each device, the console displays the controller, the node, and the address on the first line, and the device name and option on the second line.

```
>>> SHOW ETHERNET
Ethernet Adapter
-EZA0 (08-00-2B-0B-29-14)
```

```
>>> SHOW LANGUAGE
English (United States/Canada)
>>>
```

```
>>> SET LANGUAGE 5
>>>
```

In that example, selection 5 is English, chosen from the language selection menu that displays at power-up.

```
>>> SET BOOT MIA5
>>>
```

In that example, entering MIA5 sets the tape drive as the default boot device. Table 1-3 lists all supported device names.

**Table 1-3: Device Names**

Device Type	Controller/Adapter	Device Logical Name
RF-series ISE	Embedded DSSI host adapter (part of CPU)	DImu <sup>1</sup>
	KFQSA DSSI storage adapter	DUcu <sup>2</sup>
TF-series tape drive	Embedded DSSI host adapter (part of CPU)	MImu <sup>1</sup>
	KFQSA DSSI storage adapter	MUcu <sup>2</sup>
TK70 tape drive	TQK70	MUcu <sup>3</sup>
TLZ04 tape drive	KZQSA adapter	MKAn
PROM (programmable read-only memory)	MRV11 module	PRAu

<sup>1</sup>m = DSSI bus adapter (A = internal bus (0); B = external bus (1).)

u = unit number (device unit numbers must be unique throughout the system).  
When under operating system control, DIBu devices are recognized as DIAu devices.

<sup>2</sup>c = MSCP controller designator (A = first, B = second, and so on.)

u = unit number (device unit numbers must be unique throughout the system).

<sup>3</sup>c = TMSCP controller designator (A = first, B = second, and so on.)

u = unit number



**Table 1–3 (Cont.): Device Names**

<b>Device Type</b>	<b>Controller/Adapter</b>	<b>Device Logical Name</b>
Ethernet adapter	On-board (part of CPU)	EZA0
	DESQA Ethernet controller	XQAu
RA-series drives	KDA50	DUcu <sup>2</sup>

<sup>2</sup>c = MSCP controller designator (A = first, B = second, and so on.)  
u = unit number (device unit numbers must be unique throughout the system).

## **1.5 Digital Storage Systems Interconnect (DSSI)**

The KA6nn CPU module contains two DSSI bus adapters that are dedicated to the mass storage devices in your system.

The DSSI adapters provide a path to two separate DSSI busses (Bus 0 and Bus 1) through which the CPU can communicate with DSSI devices.

Each DSSI bus has the following characteristics.

- A 4-Mbytes-per-second bandwidth
- Up to eight nodes (one interface and up to seven additional DSSI Devices (RF-series ISEs, TF85s, and adapters))
- Eight data lines
- One parity line
- Eight control lines

DSSI architecture improves system performance as follows.

- The DSSI bus handles all mass storage transactions.
- Mass storage devices can act independently, since each device contains its own controller. Several devices can work simultaneously.

The two DSSI bus interfaces support up to 16 nodes. These 16 nodes include the 2 DSSI interfaces and 14 additional DSSI devices.

An ISE can maintain connection to more than one DSSI interface. That feature allows ISEs to be shared by multiple CPUs in a DSSI VAXcluster configuration.

For more information about DSSI VAXcluster configurations and the advantages of such configurations, see the section on DSSI VAXcluster capability in your system *Operation* manual.



## 1.6 KA675-AA CPU Specifications

The Model 400 system uses the timesharing KA675-AA CPU (L4002-BA).

---

### Central Processing Unit

---

Addressing modes	General register: 8 Program counter: 4 Index: 9
Clock rate	250 MHz (16 ns cycle)
Data path width	64 bits
Number of data types	Hardware: 9 Software emulated: 7
Number of instructions	Hardware: 242 Microcode assisted: 21 Software emulated: 41
General purpose registers	16 (32-bit wide) Interval timer: 1 (programmable) Programmable timers: 2
I/O bus interface	One Q22-bus interface with 8192 entry scatter/gather map
Q-bus backplane termination	240 $\Omega$

---

### Memory Management and Control

---

Page size	512 bytes
Virtual address space	4 gigabytes
Physical memory space	512 Mbytes
Number of memory modules	4 maximum

---

### Architecture

---

Instruction prefetch buffer size	16 bytes
Primary Cache	

---

## Architecture

---

Data stored	Instruction stream and data
Write algorithm	Write-through
Size	8 Kbyte
Speed	14 nanoseconds
Associativity	Two-way
Back-up Cache	
Data stored	Instruction stream and data
Write algorithm	Write-back
Size	128 Kbytes
Speed	80 nanoseconds
Associativity	Direct mapped
Translation buffer	
Size	96 entry
Associativity	Fully associative
Q22-bus address translation	
Q22-bus map cache	
Size	16 entry
Associativity	Fully associative
Q22-bus I/O bus buffer size	
Input	32 bytes
Output	4 bytes
Q22-bus Maximum I/O bandwidth	
Block mode DMA read	2.4 Mbytes/second
Block mode DMA write	3.3 Mbytes/second

---

## Ethernet Port

---

Supported protocols	Ethernet V2.0 (IEEE 802.3)
Supported media types	Standard or ThinWire
Data path width	1 bit

---

## Ethernet Port

---

Data rate	10 Mbits/second
Buffer size	
Transmit buffer	128 bytes
Receiver buffer	128 bytes

---

## Digital Storage System Interconnect (DSSI)

---

Number of DSSI interfaces	2
Maximum number of supported devices	14 <sup>1</sup> (7 per DSSI interface)
Data stored	Instruction stream and data
Write algorithm	Write-through
Data path width	8 bits
Maximum bandwidth	4 Mbytes/second
Maximum queue I/O rate	2400/second
Buffer size	
Transmit buffer	256 bytes
Receiver buffer	256 bytes

---

## Console Serial Line

---

Interface standards	EIA RS-423-A/CCITT V.10 X.26 EIA RS-232-C/CCITT V.28 DEC-423
Data format	1 start bit, 8 data bits, 0 parity bits, 1 stop bit
Baud rates	300; 600; 1200; 2400; 4800; 9600; 19,200; 38,400

---

## Ordering Information

---

Included as part of base system

---

<sup>1</sup>Additional DSSI devices are supported via the KFQSA DSSI host adapter.



---

## Configuration Information

---

Form factor	Quad height
Power requirements	
CPU module only	+5 Vdc, 2.8 A; +3.3 Vdc, 3.2 A +12 Vdc, 0.00 A; -12 Vdc, 0.00 A (24.6 W total)
CPU module, console module, and backplane termination	+5 Vdc, 4.8 A; +3.3 Vdc, 3.2 A +12 Vdc, 1.6 A; -12 Vdc, 0.00 A (53.8 W total)
Bus loads	4.0 ac; 1.0 dc

---

## Operating System Support

---

VMS	Version 5.5 and later
-----	-----------------------

---

## Diagnostic Support

---

MicroVAX Diagnostic Monitor	Release 136 and later
Self-tests	Yes

---

## Related Documentation

---

EK-KA675-TM	KA675 CPU Technical Manual
EK-454AA-MG	KA675 CPU System Maintenance

---

## 1.7 KA680-AA CPU Specifications

The Model 500 system uses the timesharing KA680-AA CPU (L4002-BA).

---

### Central Processing Unit

---

Addressing modes	General register: 8 Program counter: 4 Index: 9
------------------	---

---

## Central Processing Unit

---

Clock rate	286 MHz (14 ns cycle)
Data path width	64 bits
Number of data types	Hardware: 9 Software emulated: 7
Number of instructions	Hardware: 242 Microcode assisted: 21 Software emulated: 41
General purpose registers	16 (32-bit wide) Interval timer: 1 (programmable) Programmable timers: 2
I/O bus interface	One Q22-bus interface with 8192 entry scatter/gather map
Q-bus backplane termination	240 $\Omega$

---

## Memory Management and Control

---

Page size	512 bytes
Virtual address space	4 gigabytes
Physical memory space	512 Mbytes
Number of memory modules	4 maximum

---

## Architecture

---

Instruction prefetch buffer size	16 bytes
Virtual instruction cache	
Data stored	Instruction stream only
Size	2 Kbyte
Speed	14 nanoseconds
Associativity	Direct mapped
Primary Cache	
Data stored	Instruction stream and data

---

## Architecture

---

Write algorithm	Write-through
Size	8 Kbyte
Speed	14 nanoseconds
Associativity	Two-way
<b>Back-up Cache</b>	
Data stored	Instruction stream and data
Write algorithm	Write-back
Size	128 Kbytes
Speed	56 nanoseconds
Associativity	Direct mapped
<b>Translation buffer</b>	
Size	96 entry
Associativity	Fully associative
<b>Q22-bus address translation</b>	
<b>Q22-bus map cache</b>	
Size	16 entry
Associativity	Fully associative
<b>Q22-bus I/O bus buffer size</b>	
Input	32 bytes
Output	4 bytes
<b>Q22-bus Maximum I/O bandwidth</b>	
Block mode DMA read	2.4 Mbytes/second
Block mode DMA write	3.3 Mbytes/second

---

## Ethernet Port

---

Supported protocols	Ethernet V2.0 (IEEE 802.3)
Supported media types	Standard or ThinWire
Data path width	1 bit
Data rate	10 Mbits/second



---

## **Ethernet Port**

---

### **Buffer size**

Transmit buffer	128 bytes
Receiver buffer	128 bytes

---

## **Digital Storage Systems Interconnect (DSSI)**

---

Number of DSSI interfaces	2
Maximum number of supported devices	14 <sup>1</sup> (7 per DSSI interface)
Data stored	Instruction stream and data
Write algorithm	Write-through
Data path width	8 bits
Maximum bandwidth	4 Mbytes/second
Maximum queue I/O rate	2400/second
Buffer size	
Transmit buffer	256 bytes
Receiver buffer	256 bytes

---

## **Console Serial Line**

---

Interface standards	EIA RS-423-A/CCITT V.10 X.26 EIA RS-232-C/CCITT V.28 DEC-423
Data format	1 start bit, 8 data bits, 0 parity bits, 1 stop bit
Baud rates	300; 600; 1200; 2400; 4800; 9600; 19,200; 38,400

---

## **Ordering Information**

---

Included as part of base system

---

<sup>1</sup>Additional DSSI devices are supported via the KFQSA DSSI host adapter.

---

## Configuration Information

---

Form factor	Quad height
Power requirements	
CPU module only	+5 Vdc, 2.8 A; +3.3 Vdc, 3.2 A +12 Vdc, 0.00 A; -12 Vdc, 0.00 A (24.6 W total)
CPU module, console module, and backplane termination	+5 Vdc, 4.8 A; +3.3 Vdc, 3.2 A +12 Vdc, 1.6 A; -12 Vdc, 0.00 A (53.8 W total)
Bus loads	4.0 ac; 1.0 dc

---

## Operating System Support

---

VMS	Version 5.5 and later
-----	-----------------------

---

## Diagnostic Support

---

MicroVAX Diagnostic Monitor	Release 136 and later
Self-tests	Yes

---

## Related Documentation

---

EK-KA680-TM	KA680 CPU Technical Manual
EK-454AA-MG	KA680 CPU System Maintenance

---

## 1.8 KA690-AA CPU Specifications

The Model 600 system uses the timesharing KA690-AA CPU (L4002-AA).

---

### Central Processing Unit

---

Addressing modes	General register: 8 Program counter: 4 Index: 9
------------------	---

---

## Central Processing Unit

---

Clock rate	333 MHz (12 ns cycle)
Data path width	64 bits
Number of data types	Hardware: 9 Software emulated: 7
Number of instructions	Hardware: 242 Microcode assisted: 21 Software emulated: 41
General purpose registers	16 (32-bit wide) Interval timer: 1 (programmable) Programmable timers: 2
I/O bus interface	One Q22-bus interface with 8192 entry scatter/gather map
Q-bus backplane termination	240 $\Omega$

---

## Memory Management and Control

---

Page size	512 bytes
Virtual address space	4 gigabytes
Physical memory space	512 Mbytes
Number of memory modules	4 maximum

---

## Architecture

---

Instruction prefetch buffer size	16 bytes
Virtual instruction cache	
Data stored	Instruction stream only
Size	2 Kbyte
Speed	12 nanoseconds
Associativity	Direct mapped
Primary Cache	
Data stored	Instruction stream and data



---

## Architecture

---

Write algorithm	Write-through
Size	8 Kbyte
Speed	12 nanoseconds
Associativity	Two-way
Back-up Cache	
Data stored	Instruction stream and data
Write algorithm	Write-back
Size	512 Kbytes
Speed	36 nanoseconds
Associativity	Direct mapped
Translation buffer	
Size	96 entry
Associativity	Fully associative
Q22-bus address translation	
Q22-bus map cache	
Size	16 entry
Associativity	Fully associative
Q22-bus I/O bus buffer size	
Input	32 bytes
Output	4 bytes
Q22-bus Maximum I/O bandwidth	
Block mode DMA read	2.4 Mbytes/second
Block mode DMA write	3.3 Mbytes/second

---

## Ethernet Port

---

Supported protocols	Ethernet V2.0 (IEEE 802.3)
Supported media types	Standard or ThinWire
Data path width	1 bit
Data rate	10 Mbits/second

---

**Ethernet Port**

---

**Buffer size**

Transmit buffer	128 bytes
Receiver buffer	128 bytes

---

**Digital Storage Systems Interconnect (DSSI)**

---

Number of DSSI interfaces	2
Maximum number of supported devices	14 <sup>1</sup> (7 per DSSI interface)
Data stored	Instruction stream and data
Write algorithm	Write-through
Data path width	8 bits
Maximum bandwidth	4 Mbytes/second
Maximum queue I/O rate	2400/second
Buffer size	
Transmit buffer	256 bytes
Receiver buffer	256 bytes

---

**Console Serial Line**

---

Interface standards	EIA RS-423-A/CCITT V.10 X.26 EIA RS-232-C/CCITT V.28 DEC-423
Data format	1 start bit, 8 data bits, 0 parity bits, 1 stop bit
Baud rates	300; 600; 1200; 2400; 4800; 9600; 19,200; 38,400

---

**Ordering Information**

---

Included as part of base system

---

<sup>1</sup>Additional DSSI devices are supported via the KFQSA DSSI host adapter.

---

## Configuration Information

---

Form factor	Quad height
Power requirements	
CPU module only	+5 Vdc, 2.8 A; +3.3 Vdc, 3.2 A +12 Vdc, 0.00 A; -12 Vdc, 0.00 A (24.6 W total)
CPU module, console module, and backplane termination	+5 Vdc, 4.8 A; +3.3 Vdc, 3.2 A  +12 Vdc, 1.6 A; -12 Vdc, 0.00 A (53.8 W total)
Bus loads	4.0 ac; 1.0 dc

---

## Operating System Support

---

VMS	Version 5.5 and later
-----	-----------------------

---

## Diagnostic Support

---

MicroVAX Diagnostic Monitor	Release 136 and later
Self-tests	Yes

---

## Related Documentation

---

EK-KA690-TM	KA690 CPU Technical Manual
EK-454AA-MG	KA600 CPU System Maintenance

---

## 1.9 MS690 Memory Specifications

The MS690 memory module provides memory expansion for the KA6nn-AA CPU module. The MS690 modules interface with the CPU through the MS690 local memory interconnect.

You can use up to four MS690 modules in your system.

Operating system support and diagnostic support are the same as for the KA6nn CPU module, as listed in either Section 1.7 or Section 1.8.



---

**Performance**

---

	Memory Cycle Time with KA6nn:
Hexaword Memory Read (32 bytes):	588 ns
Hexaword Memory write	
Hexaword	546 ns
Masked (octaword, Longword)	1050 ns

---

**Performance**

---

Memory data path width	64 bits
------------------------	---------

---

**Ordering Information**

---

MS690-BA	32-Mbyte field-installed kit
MS690-CA	64-Mbyte field-installed kit
MS690-DA	128-Mbyte field-installed kit

---

**Configuration Information**

---

Form factor	Quad height
Power Requirements	
MS690-BA	+5V; 5.3 A; 26.5 W
MS690-CA	+5V; 4.2 A; 21.0 W
MS690-DA	+5V; 6.4 A; 32.0 W

---

## Chapter 2

# Option Specifications

---

This chapter lists specifications for the options currently supported in your system, grouped as follows.

- Mass storage
- Communications
- Real-time
- Printer
- Graphics

The specifications appear in alphanumerical order within each of the above groups. All weights are approximate.

Some of the options are already installed in your system. If you want to add other options, your Digital sales representative can advise you.

## 2.1 Options Overview

The option specifications include the following, where applicable.

- Functional information
- Ordering information
- Performance
- Configuration information
- Related documentation

### 2.1.1 Configuration

Options must be properly configured so that the system recognizes them.

Each option in a system has a device address, commonly referred to as a control and status register (CSR) address, and an interrupt vector that must be set when the option is installed. Options are usually configured by

setting switches or jumpers on modules already configured at the factory or Digital service representatives configure the option when they install it in your system.

Self-maintenance customers can find information on setting CSR addresses and interrupt vectors in the *Microsystems Options* volume of the *Entry Systems Service* kit.

## 2.2 Mass Storage Options

Your system supports the following mass storage devices.

- Internal to the BA440 enclosure:
  - TK-series tape drive
  - TF-series tape drive
  - TLZ04 tape drive
  - RF-series integrated storage element (ISE)
- External to the BA440 enclosure:
  - RRD-series compact disk subsystem (tabletop)
  - TU81-Plus tape drive
  - TSV-series tape drive
  - TSZ07 tape drive
  - TLZ04 tape drive (tabletop)
  - RA-series disk drive
  - TF-series tape drive (tabletop)

Four RA-series drives are supported by one KDA50 controller. Up to seven ISEs are supported by one KFQSA.

Using the dual-disk RF35, up to seven ISEs can be installed in your system. The CPU communicates with the ISEs through a Digital Storage Systems Interconnect (DSSI) adapter, which is built into the CPU. Your system has two DSSI adapters, and hence, two separate DSSI busses. Each DSSI bus is capable of supporting seven integrated storage elements.

The system can support two additional adapters (KFQSA, KDA50, KZQSA, and KLESI) provided the system and Q-bus requirements are met.

### 2.2.1 KDA50 Controller

The KDA50 is an intelligent controller that interfaces with up to four SDI-compatible mass storage devices on the Q22-bus.



---

**Functional Information**

---

Controller protocol	MSCP
Bad block replacement	Software dependent
Supported drives	RA60, RA70, RA81, RA82, RA90
Drives per controller	4
Controllers per system	1 maximum for VMS 5.1 2 maximum for VMS V5.2 and later
Drive interconnect	Transformer-coupled radial

---

**Ordering Information**

---

KDA50-SE	Factory-installed RA-series disk drive controller, controls up to a maximum of four RA-series devices, uses three QBUS slots.
KDA50-SG	Same as -SE but is field-installed.

---

**Performance**

---

Read/Write data transfers	Up to 16-byte block mode DMA
Data buffering	32 Kbytes
Command buffering	20 command and response ring buffers

---

**Configuration Information**

---

Form factor	Two quad height
Power requirements	+5 Vdc, 13.5 A (typocal); +12 Vdc, 0.03 A (typical)
Power consumption	67.86 W
Bus loads	3.0 ac; 0.5 dc

---

**Related Documentation**

---

EK-KDA5Q-UG	KDA50-Q User's Guide
-------------	----------------------

---

## 2.2.2 KFQSA Storage Adapter

The KFQSA is an intelligent storage adapter that allows Q22-bus systems to communicate with storage peripherals based on the Digital Storage System Interconnect (DSSI).

---

### Functional Information

---

Controller protocol	MSCP: to and from Q22-bus host DSSI: to and from storage devices
Supported devices	RF-series ISEs, also TF85s and other DSSI adapters
Drives per adapter	7
Drive interconnect	Direct
Controllers per system	2 maximum

---

### Ordering Information

---

KFQSA-SE	Factory-installed Q-Bus to DSSI adapter, controls up to a maximum of 7 DSSI devices
KFQSA-SG	Same as -SE but is field-installed

---

### Performance

---

Peak transfer rate	4 Mbytes/second
Sustained transfer rate	1.5 Mbytes/second
I/O request throughput	190 I/O requests/second (single-sector reads)
Error detection	DSSI bus parity and check character, all transmissions

---

### Configuration Information

---

Form factor	Quad height
Power requirements	+5 Vdc, 5.5 A (typical)
Power consumption	27.5 W
Bus loads	4.4 ac; 0.5 dc

---

**Related Documentation**

---

**EK-KFQSA-IN****KFQ Storage Adapter Installation and User Manual**

---

**2.2.3 KLESI Controller**

The KLESI-SA is a controller that interfaces with the TU81-Plus tape drive on the Q22-bus.

---

**Functional Information**

---

Controller protocol	TMSCP
Supported drive	TU81-Plus
Drives per adapter	1
Drive interconnect	Direct
Controllers per system	1 maximum

---

---

**Ordering Information**

---

Included with the TU81-Plus tape drive

---

---

**Configuration Information**

---

Form factor	Dual
Power requirements	+5 Vdc, 4.0 A (typical); +12 Vdc, 0.0 A (typical)
Power consumption	20.0 W
Bus loads	0.5 ac; 1.0 dc

---

---

**Related Documentation**

---

**EK-LESIB-UG****KLESI-B Module User's and Installation Guide**

---

**2.2.4 KZQSA Storage Adapter**

The KZQSA storage adapter controls the TLZ04 and RRD-series devices on the Q22-bus.



---

**Functional Information**

---

Adapter protocol	TMSCP
Supported drive	TLZ04, RRD42; two external cables or two devices
Controllers per system	2

---

**Ordering Information**

---

KZQSA-SA	For external factory-installed TMSCP storage adapters
KZQSA-SF	Same as -SA but is field-installed

---

**Performance Information**

---

Peak transfer rate	4 Mbytes synchronous
Error detection	Q-bus parity

---

**Configuration Information**

---

Form factor	Quad height
Power requirements	+5 Vdc, 5.5 A (typical); +12 Vdc, 0.0 A (typical)
Power consumption	27.5 W
Bus loads	4.4 ac; 1.0 dc

---

**Related Documentation**

---

EK-KZQSA-IN	KZQSA Storage Adapter Installation and User Manual
-------------	--

---

## 2.2.5 RA60 Disk Drive

The RA60 is a removable disk drive that provides 205 Mbytes of formatted storage space. Your system supports the RA60 in separate storage expansion enclosures only.

---

**Storage Capacity**

---

User capacity	205 Mbytes
---------------	------------

---

**Storage Capacity**

---

User capacity (blocks)	400,176
------------------------	---------

---

---

**Ordering Information**

---

RA60-AA	Field-installed RA60 disk drive and cables
RA60-AF	Factory-installed RA60 disk drive and cables
BC26V-06	Interconnect cable with connector block

---

---

**Performance**

---

Average seek time	41.67 milliseconds
Average rotational latency	8.33 milliseconds
Average access time	50.30 milliseconds
Peak transfer rate	15.84 Mbits/second

---

---

**Physical Specifications**

---

Height	26.52 cm (10.44 inches)
Width	48.26 cm (19 inches)
Depth	85.09 cm (33.75 inches)
Weight	68.95 kg (152 pounds)

---

---

**Configuration Information**

---

Form factor	10.5-inches high, full rack width
-------------	-----------------------------------

---

---

**Related Documentation**

---

EK-ORA60-UG	RA60 Disk Drive User's Guide
-------------	------------------------------

---

## 2.2.6 RA70E Disk Drive

The RA70E is a fixed-disk drive that provides 280 Mbytes of formatted storage space. Your system supports the RA70E drives in separate storage expansion enclosures only.

---

**Storage Capacity**

---

User capacity	280 Mbytes
---------------	------------

---

---

**Ordering Information**

---

RA70E-SA	Factory-installed RA70E disk drive
RA70E-SF	Same as -SA but is field-installed

---

---

**Performance**

---

Average seek time	19.5 milliseconds
Average rotational latency	7.5 milliseconds
Average access time	27.0 milliseconds
Peak transfer rate	1.4 Mbytes/second

---

---

**Physical Specifications**

---

Height	26.3 cm (10.38 inches)
Width	44.5 cm (17.5 inches)
Depth	67.3 cm (26.5 inches)
Weight	61.2 kg (135 pounds)
Form factor	5.25-inches high, full rack width

---

---

**Related Documentation**

---

EK-ORA70-SV	RA70 Disk Drive Service Manual
EK-ORA70-PS	RA70 Disk Drive Pocket Reference

---

## 2.2.7 RA81 Disk Drive

The RA81 is a fixed-disk drive that provides 456 Mbytes of formatted storage space. Your system supports the RA81 drives in separate storage expansion enclosures only.



---

**Storage Capacity**

---

User capacity	456 Mbytes
User capacity (blocks)	891,070

---

---

**Ordering Information**

---

RA81-HA/-HD	RA81 disk drive (120 V/240 V)
RQA81-AA	Factory-installed RA81 disk drive (120 V) with KDA50 controller and BC26V-06 cable
RQA81-AD	Field-installed RA81 disk drive (240 V) with KDA50 controller and BC26V-6D cable
BC26V-6D	Interconnect cable with connector block

---

---

**Performance**

---

Average seek time	28.00 milliseconds
Average rotational latency	8.32 milliseconds
Average access time	36.30 milliseconds
Peak transfer rate	17.4 Mbits/second

---

---

**Physical Specifications**

---

Height	26.3 cm (10.38 inches)
Width	44.5 cm (17.5 inches)
Depth	67.3 cm (26.5 inches)
Form factor	10.5-inches high, full rack width
Weight	61.2 kg (135 pounds)

---

---

**Related Documentation**

---

EK-ORA81-SV	RA81 Disk Drive Service Guide
EK-ORA81-UG	RA81 Disk Drive User's Guide

---

## 2.2.8 RA82 Disk Drive

The RA82 is a fixed-disk drive that provides 623 Mbytes of formatted storage space. Your system supports the RA82 drives in separate storage expansion enclosures only.

---

### Storage Capacity

---

User capacity	623 Mbytes
User capacity (blocks)	1,216,660

---

### Ordering Information

---

RA82-AA	Factory-installed RA82 disk drive (120 V) with one BC26V-12 cable
RA82-AD	Field-installed RA82 disk drive (240 V) with one BC26V-12 cable
BC26V-06	Interconnect cable with connector block

---

### Performance

---

Average seek time	24.00 milliseconds
Average rotational latency	8.33 milliseconds
Average access time	32.33 milliseconds
Peak transfer rate	19.2 Mbits/second

---

### Physical Specifications

---

Height	26.3 cm (10.38 inches)
Width	44.5 cm (17.5 inches)
Depth	67.3 cm (26.5 inches)
Weight	61.2 kg (135 pounds)

---

### Configuration Information

---

Form factor	10.5-inches high, full rack width
-------------	-----------------------------------

---

**Related Documentation**

---

EK-ORA82-SV	RA82 Disk Drive Service Guide
EK-ORA82-UG	RA82 Disk Drive User's Guide

---

## 2.2.9 RA90 Disk Drive

The RA90 is a fixed-disk drive that provides 1.2 gigabytes of formatted storage space. Your system supports the RA90 drives in separate storage expansion enclosures only.

---

**Storage Capacity**

---

User capacity	1.2 gigabytes
User capacity (blocks)	2,376,153

---

---

**Ordering Information**

---

RA90-NA	RA90 disk drive (120 V)
RA90-ND	RA90 disk drive (240 V)
BC26V-12	Interconnect cable with connector block

---

---

**Performance**

---

Average seek time	18.5 milliseconds
Average access time	8.33 milliseconds
Peak transfer rate	22.2 Mbits/second

---

---

**Physical Specifications**

---

Height	26.6 cm (10.4 inches)
Width	23.0 cm (8.7 inches)
Depth	68.5 cm (27.0 inches)
Weight	13.6 kg (62 pounds)

---



---

### Configuration Information

---

Form factor	10.5-inches high, full rack width
Power requirements	+5 Vdc, 1.3 A; +12 Vdc, 2.21 A
Power consumption	18.7 W

---

### Related Documentation

---

EK-ORA90-SV	RA90 Disk Drive Service Guide
EK-ORA90-UG	RA90 Disk Drive User's Guide

---

## 2.2.10 RA92 Disk Drive

The RA92 disk drive provides 1.5 Gbytes of formatted storage space. Your system supports the RA92 only in separate storage expansion enclosures.

---

### Storage Capacity

---

User capacity	1.5 gigabytes
User capacity (blocks)	2,940,952

---

### Ordering Information

---

RA92-CA/CD	RA92 disk drive (120 V @ 60 Hz; 240 V @ 50 Hz)
BC26J-xx	12-, 25-, 50-, or 80-ft. interconnect cable
BC27V-xx	12-, 15-, 25-, 35-, 50-, or 80-ft. interconnect cable

---

### Performance

---

Average seek time	16.5 milliseconds
Single track seek	3.0 milliseconds
Peak transfer rate	22.2 Mbits/second

---

### Physical Specifications

---

Height	26.6 cm (10.42 inches)
Width	23.0 cm (8.75 inches)

---

---

**Physical Specifications**

---

Depth	60.96 cm (24.0 inches)
Weight	31.8 kg (70 pounds)

---

**Configuration Information**

---

Form factor	10.5-inches high
Power requirements	+5 Vdc, 1.3 A; +12 Vdc, 2.21 A
Power consumption	18.7 W

---

**Related Documentation**

---

EK-ORA92-UG-02	RA90/RA92 User's Guide
----------------	------------------------

---

### 2.2.11 RF31 Integrated Storage Element (ISE)

The RF31 is a DSSI integrated storage element (ISE) that provides 381 Mbytes of formatted storage space. An ISE is an integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

---

**Storage Capacity**

---

Data storage capacity	381 Mbytes, formatted
-----------------------	-----------------------

---

---

**Ordering Information**

---

RF31E-AA	Factory-installed 381 Mbyte half-height ISE
RF31E-AF	Same as -AA but is field-installed

---

---

**Performance**

---

Average seek time	14.7 milliseconds
Average access time	23 milliseconds
Average rotational latency	8.33 milliseconds
Peak transfer rate	4.0 Mbytes/second

---

**Physical Specifications**

---

Height	4.40 cm (1.75 inches)
Width	14.60 cm (5.75 inches)
Depth	20.45 cm (8.25 inches)
Weight	1.81 kg (4.0 pounds)

---

**Configuration Information**

---

Form factor	Standard 5.25-inch footprint
Power requirements (peak at spin-up)	+5 Vdc, 1.0 A; +12 Vdc, 2.80 A
Power consumption	38.6 W (peak at spin-up)
	18.7 W (seeking)
	12.6 W (idle)

---

## 2.2.12 RF31F Integrated Storage Element

The RF31F is a DSSI integrated storage element (ISE) that provides 200 Mbytes of formatted storage space. The RF31F features a code modification to the UVE ROM that makes the RF31F a half-stroke drive.

---

**Storage Capacity**

---

Data storage capacity	200 Mbytes, formatted
-----------------------	-----------------------

---

---

**Ordering Information**

---

RF31F-AA	Factory-installed 200-Mbyte half-height ISE
RF31F-AF	Same as -AA but is field-installed

---

---

**Performance**

---

Average seek time	12.3 milliseconds
Average access time	20.6 milliseconds
Average rotational latency	8.37 milliseconds
Peak transfer rate	4.0 Mbytes/second



---

**Performance**

---

Transfer rate from the media	2.0 Mbytes/second
------------------------------	-------------------

---

---

**Physical Specifications**

---

Height	4.40 cm (1.75 inches)
Width	14.60 cm (5.75 inches)
Depth	20.45 cm (8.25 inches)
Weight	1.81 kg (4.0 pounds)

---

---

**Configuration Information**

---

Form factor	Standard 5.25-inch footprint
Power requirements (peak at spin-up)	+5 Vdc, 1.0 A; +12 Vdc, 2.80 A
Power consumption	38.6 W (peak at spin-up)
	18.7 W (seeking)
	12.6 W (idle)

---

---

**Related Documentation**

---

EK-RF72D-UG	RF Series Integrated Storage Element User Guide
EK-RF72D-SV	RF Series Integrated Storage Element Service Guide

---

### 2.2.13 RF35 Integrated Storage Element

The RF35 is a DSSI integrated storage element (ISE) that provides 852 Mbytes of formatted storage space.

---

**Storage Capacity**

---

Data storage capacity	852 Mbytes, formatted
-----------------------	-----------------------

---

---

### Ordering Information

---

RF35U-AF	Field-installed RF35 maintenance option for upgrading to a RF35E-Ax to a RF352-Ax
RF35E-AA	Factory-installed in the BA400-based systems; single-drive unit
RF35E-AF	Same as -AA but is field-installed
RF352-AA	Factory-installed in the BA400-based systems; dual-drive
RF352-AF	Same as -AA but is field-installed

---

### Performance

---

Average seek time	9.5 milliseconds
Average access time	15.1 milliseconds
Average rotational latency	5.56 milliseconds
Peak transfer rate	4.0 Mbytes/second
Transfer rate from the media	2.7 Mbytes/second
Buffer size	512K cache

---

### Physical Specifications

---

Height	4.08 cm (1.63 inches)
Width	10 cm (4.00 inches)
Depth	14.38 cm (5.75 inches)
Weight	0.81 kg (1.8 pounds)

---

### Configuration Information

---

Form factor	Standard 3.5-inch footprint
Data surfaces	14
Bits per inch	48,300
Tracks per inch	2650
Power requirements	+5 Vdc, 0.71 A; +12 Vdc, 2.29 A (spin-out)
Power consumption	31.1 W (peak at spin-up)

---

**Configuration Information**

---

13.8 W (seeking)

11.3 W (idle)

---

**Related Documentation**

---

EK-RF72D-UG

RF Series Integrated Storage Element User Guide

EK-RF72D-SV

RF Series Integrated Storage Element Service Guide

---

### 2.2.14 RF71 Integrated Storage Element (ISE)

The RF71 is a DSSI integrated storage element (ISE) that provides 400 Mbytes of formatted storage space. An ISE is an integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

---

**Storage Capacity**

---

User capacity 400 Mbytes

User capacity (blocks) 781,440

---

**Ordering Information**

---

RF71E-AA

Factory-installed 400 Mbyte ISE

RF71E-AF

Same as -AA but is field-installed

---

---

**Performance**

---

Average random seek time 19.20 milliseconds

Average rotational latency 8.33 milliseconds

Average access time 34.2 milliseconds

Peak transfer rate 4.0 Mbits/second

Transfer rate from the media 1.5 Mbits/second



---

**Physical Specifications**

---

Height	7.75 cm (3.05 inches)
Width	14.60 cm (5.75 inches)
Depth	20.75 cm (8.17 inches)
Weight	4.09 kg (9.0 pounds)

---

**Configuration Information**

---

Form factor	Standard 5.25-in footprint
Power requirements	+5 Vdc, 1.25 A; +12 Vdc, 1.64 A
Power consumption	25.93 W

---

**Related Documentation**

---

EK-RF71D-IM	RF71 Disk Drive Installation Manual
EK-RF71D-UG	RF71 Disk Drive User's Guide

---

### 2.2.15 RF72 Integrated Storage Element (ISE)

The RF72 is a DSSI integrated storage element (ISE) that provides 1.0 Gbytes of formatted storage space. RF-series ISEs are used in DSSI busses (Digital Storage Systems Interconnect). An ISE is a 5.25-inch integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

---

**Storage Capacity**

---

User capacity	1.0 Gbytes
---------------	------------

---

**Ordering Information**

---

RF72E-AA	Factory-installed 1.0 Gbyte ISE
RF72E-AF	Same as -AA but is field-installed

---

---

**Performance**

---

Average seek time	13.4 milliseconds
-------------------	-------------------

---

**Performance**

---

Average access time	21.7 milliseconds
Average rotational latency	8.33 milliseconds
Peak transfer rate	4.0 Mbytes/second
Transfer rate from the media	2.0 Mbytes/second

---

**Physical Specifications**

---

Height	7.75 cm (3.05 inches)
Width	14.60 cm (5.75 inches)
Depth	20.75 cm (8.17 inches)
Weight	4.09 kg (9.0 pounds)

---

**Configuration Information**

---

Form factor	Standard 5.25-inch high footprint
Power requirements (spin-up)	+5 Vdc, 1.1 A; +12 Vdc, 4.25 A
Power consumption	56.5 W (peak at spin-up) 28.9 W (seeking) 17.7 W (idle)

---

**Related Documentation**

---

EK-RF72D-UG	RF Series Integrated Storage Element User Guide
EK-RF72D-SV	RF Series Integrated Storage Element Service Guide

---

### 2.2.16 RF73 Integrated Storage Element (ISE)

The RF73 is a DSSI integrated storage element (ISE) that provides 2.0 Gbytes of formatted storage space. RF-series ISEs are used in DSSI busses (Digital Storage Systems Interconnect). An ISE is an integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

---

**Storage Capacity**

---

User capacity	2.0 Gbytes
---------------	------------

---

---

**Ordering Information**

---

RF73E-AA	Factory-installed 2.0 Gbyte ISE
RF73E-AF	Same as -AA but is field-installed

---

---

**Performance**

---

Average seek time	12.9 milliseconds
Average access time	21.3 milliseconds
Average rotational latency	8.33 milliseconds
Peak transfer rate	4.0 Mbytes/second
Transfer rate from the media	2.2 Mbytes/second

---

---

**Physical Specifications**

---

Height	8.26 cm (3.25 inches)
Width	14.71 cm (5.79 inches)
Depth	20.85 cm (8.21 inches)
Weight	2.89 kg (6.36 pounds)

---

---

**Configuration Information**

---

Form factor	Standard 5.25-inch high footprint
Power requirements (spin-up)	+5 Vdc, 1.0 A; +12 Vdc, 4.30 A
Power consumption	56.6 W (peak at spin-up)
	22.9 W (seeking)
	17.0 W (idle)

---

---

**Related Documentation**

---

EK-RF72D-UG	RF Series Integrated Storage Element User Guide
-------------	---

---



---

**Related Documentation**

---

EK-RF72D-SV

RF Series Integrated Storage Element Service  
Guide

---

## 2.2.17 RRD40 Compact-Disc Subsystem

The RRD40 is a CD reader that retrieves data in fixed-length blocks from removable compact-disc media.

---

**Functional Information**

---

Modes	Idle mode Operation mode: search, normal play
Orientation	Horizontal

---

---

**Ordering Information**

---

RRD40-AF	Field-installed tabletop CDROM drive
----------	--------------------------------------

---

---

**Performance**

---

Motor stop time	30% of nominal speed within 30 seconds maximum, 5 seconds typical
Motor start time	90% of nominal speed within 20 seconds maximum, less than 11 seconds typical
Formatted capacity	525 Mbytes with maximum of 600 Mbytes
Average transfer rate	153.6 Kbytes/s, mode 1; 176.4 Kbytes/s, mode 2
Average latency	60 $\mu$ s maximum inner track; 155 $\mu$ s outer track
Initialization time	15 seconds maximum to sector zero

---

---

**Physical Specifications**

---

Height	27.6 cm (11.02 inches)
Width	8.18 cm (3.27 inches)
Depth	22.7 cm (9.06 inches)
Weight	5.0 kg (11.0 pounds)

---

**Configuration Information**

---

Power consumption	19.2 W maximum; Play mode: 18 W maximum
-------------------	---

---

---

**Related Documentation**

---

EK-RRD40-OM	RRD40 Disk Drive Owner's Manual
EK-RRD40-SU	RRD40 MicroVAX Monitor User's Guide Updates

---

## 2.2.18 RRD42 Optical Compact-Disc Subsystem

The RRD42 is a 600-Mbyte optical CD reader that retrieves data in fixed-length blocks from removable compact-disc media.

---

**Functional Information**

---

Interface	Single-ended, asynchronous to Q-bus systems through KZQSA storage adapter
-----------	--

---

---

**Ordering Information**

---

RRD42-DA	Tabletop model, with power supply
RRD42-FB	Tabletop, 240 V
RRD42-DH	Tabletop, 120 V

---

---

**Performance**

---

Seek time, average	400 millisecond, (typical)
Seek time, max full stroke	800 millisecond, (typical)
Rotational speed, innermost track	530 rpm
Rotational speed, outermost track	200 rpm
Start time/Stop time	2.0 second (maximum)
Transfer rate, sustained	150 Kbytes/second
Transfer rate, burst	1.50 Mbytes/second (maximum)

---

**Physical Specifications**

---

Height	4.15 cm (1.62 inches)
Width	14.60 cm (5.75 inches)
Depth	20.80 cm (8.0 inches)
RRD42-AA	1.30 kg (2.8 pounds)
RRD42-DA	2.9 kg (6.30 pounds)

---

**Configuration Information**

---

Form factor	Standard 5.25-inch high footprint
-------------	-----------------------------------

---

**Related Documentation**

---

EK-RRD42-OM	RRD42 Disc Drive Owner's Manual
-------------	---------------------------------

---

## 2.2.19 TF85 Tape Drive

The TF85 is a cartridge tape drive that can store up to 2.6 Gbytes. It is a streaming tape drive with a built-in DSSI (Digital Storage Systems Interconnect) controller, and can be used as a part of a DSSI VAXcluster configuration.

---

**Functional Information**

---

Recording media	Magnetic, metal-particle tape
Tape dimensions	1.27 cm (0.5 inch) wide, 366 m (1100 feet) long
Mode of operation	Streaming
Recording method	Serpentine
Recording density	42,500 bits/inch
Number of tracks	48
Storage capacity	2.6 Gbytes, formatted
Transfer rate	800 Kbytes/second, formatted



---

### Ordering Information

---

TF85-BA	2.6-Gbyte cartridge tape subsystem for DSSI-based systems; includes tape drive, DSSI controller, tape cartridge, and head cleaning cartridge
TF85E-JA	Same as -BA but factory-installed embedded BA400-series
TF85E-JF	Same as -BA but field-installed embedded BA400-series
TF85-TA	Same as -BA but tabletop, 120 V

---

### Performance

---

Tape start time	300 milliseconds maximum
Tape stop time	300 milliseconds maximum
Tape speed	390 cm/second (100 in/second)
Streaming data rate	800 Kbytes/second
Access time	
TF85 mode	3 minutes maximum
TK70/50 mode	60 minutes maximum
Recording technique	Two-track parallel, serpentine
Burst rate on DSSI bus	3.8 Mbytes/second

---

### Physical Specifications

---

Height	8.25 cm (3.25 inches)
Width	14.60 cm (5.70 inches)
Depth	21.44 cm (8.44 inches)
Weight	15.4 kg (7.0 pounds)

---

### Configuration Information

---

Form factor	Half-rack, near 5.25-inch footprint
Power requirements	+5 Vdc, 1.8 A (typical); +12 Vdc, 1.0 A (typical)
Power consumption	36.3 W

---

---

**Related Documentation**

---

EK-OTF85-OM	TF85 Cartridge Tape Subsystem Owner's Manual
EK-OTK85-RC	TF85 Cartridge Tape Drive Reference Card

---

## 2.2.20 TK50 Tape Drive

The TK50 is a streaming-tape drive subsystem that can store up to 95 Mbytes on a tape cartridge for backup data storage.

---

**Functional Information**

---

Recording media	Magnetic tape
Tape dimensions	1.27 cm (0.5 inch) wide, 182.9 m (600 feet) long
Mode of operation	Streaming
Recording method	Serpentine
Recording density	6667 bits/inch
Number of tracks	22
Storage capacity	94.5 Mbytes formatted

---

---

**Ordering Information**

---

TK50E-AA	Factory-installed 95-Mbyte cartridge tape drive
TK50E-AF	Field-installed 95-Mbyte cartridge tape drive
TQK50-SF	Field-installed controller for TK50E-AF
TQK50-SA	Same as -SF but is factory-installed

---

---

**Performance**

---

Tape start time	300 milliseconds maximum
Tape speed	2925 cm (75 inches)/second
Streaming data rate	62 Kbytes/second
Access time (from insertion of tape)	60 minutes maximum

---

**Physical Specifications**

---

Height	8.25 cm (3.25 inches)
Width	14.60 cm (5.70 inches)
Depth	21.44 cm (8.44 inches)
Weight	2.27 kg (5.0 pounds)

---

**Configuration Information**

---

Form factor	Standard 5.25-inch footprint
Power requirements	+5 Vdc, 1.5 A; +12 Vdc, 2.4 A
Power consumption	36.3 W

---

**Related Documentation**

---

EK-LEP05-OM	TK50 Tape Drive Subsystem Owner's Manual
EK-OTK50-UG	TK50 Tape Drive Subsystem Users Guide

---

## 2.2.21 TK70 Tape Drive

The TK70 is a streaming-tape drive subsystem that can store up to 296 Mbytes on a tape cartridge for backup data storage. The TK70 can read data from cartridges recorded on a TK50 drive, but cannot write data to cartridges recorded on a TK50 drive.

---

**Functional Information**

---

Recording media	Magnetic tape
Tape dimensions	1.27 cm (0.5 inch) wide, 182.9 m (600 feet) long
Mode of operation	Streaming
Recording method	Serpentine
Recording density	10,000 bits/inch
Number of tracks	48
Storage capacity	296 Mbytes formatted



---

### Ordering Information

---

TK70E-AA	Factory-installed 296 Mbyte cartridge tape drive
TK70E-AF	Same as -AA but is field-installed
TQK70-SF	Field-installed controller for TK70E-AF
TQK70-SA	Same as -SF but is factory-installed

---

### Performance

---

Tape start time	325 milliseconds maximum
Tape stop time	200 milliseconds maximum
Tape speed	390 cm/second (100 in/second)
Streaming data rate	125 Kbytes/second
Access time (from insertion of tape)	60 minutes maximum

---

### Physical Specifications

---

Height	8.25 cm (3.25 inches)
Width	14.60 cm (5.70 inches)
Depth	21.44 cm (8.44 inches)
Weight	2.27 kg (5.0 pounds)

---

### Configuration Information

---

Form factor	Standard 5.25-inch footprint
Power requirements	+5 Vdc, 1.35 A; +12 Vdc, 2.4 A
Power consumption	35.6 W

---

### Related Documentation

---

EK-OTK70-OM	TK70 Tape Drive Subsystem Owner's Manual
EK-OTK70-TM	TK70 Tape Drive Subsystem Technical Manual
EK-OTK70-SM	TK70 Tape Drive Subsystem Service Manual

---

## 2.2.22 TLZ04 Tape Drive

The TLZ04 is a 1.2-Gbyte cassette (DAT) SCSI tape drive, either tabletop or embedded in your system.

---

### Functional Information

---

Recording media	Magnetic tape
Mode of operation	Streaming and start/stop
Storage capacity	1.2 Gbytes formatted
Drive interface	RDAT compatible

---

### Ordering Information

---

TLZ04-JA	Factory-installed embedded BA400-series
TLZ04-JF	Field-installed embedded BA400-series
TLZ04-GA	Tabletop including BC06P cable

---

### Performance

---

Passes per cassette tape	300
Media	TLZ04-CA cassette tape
Bit density	114 Mbits/square inch
Transfer rate (sustained)	183 Kbytes/second
Recording format	Digital data storage (DDS)
Read/write speed	0.87 cm/second
Peak transfer rate, raw	180 Kbytes/second
Peak transfer rate, user data	170 Kbytes/second
Average file access time	20 seconds
Rewinding time	40 seconds

---

### Physical Specifications

---

Height	10.0 cm (3.8 inches), tabletop
	8.2 cm (3.35 inches), embedded

---

---

**Physical Specifications**

---

Width	32.5 cm (12.7 inches), tabletop
	14.60 cm (5.70 inches), embedded
Depth	28.5 cm (11.2 inches), tabletop
	21.44 cm (8.44 inches), embedded
Weight	7.72 kg (17 pounds), tabletop
	2.20 kg (7.72 pounds), embedded

---

**Data Organization**

---

Recording technology	Helical scan
Recording method	Digital Data Storage (DDS)
Recording density	61,000 bits/inch
Record size	Variable
Maximum capacity	1.2 Gbytes, formatted
Recording medium	60 m x 4 mm

---

**Maintenance**

---

Recommended cartridge cleaning	Every 25 hours
--------------------------------	----------------

---

**Configuration Information**

---

Form factor	5.25-inch DAT drive
Power requirements	90 to 132 V, 1.6 A; 198.0 to 264 V, 1.0 A
Power consumption (embedded)	15.0 W
Power consumption (tabletop)	50.0 W

---

**Related Documentation**

---

EK-TLZ04-MM	TLZ04 Tape Drive Subsystem Service Manual
EK-BA400-IN	Tape Drive Subsystem Service Manual
EK-TLZ04-OM	TLZ04 Tape Drive Owner's Manual

---



### 2.2.23 TSZ07 Tape Drive

The TSZ07 is a 40-Mbyte, high-capacity, streaming, 9-track, reel-to-reel, half-inch magnetic tape drive with dual recording densities. The TSZ07 is available in tabletop, cabinet, or rackmount models, and cannot be mounted inside your system.

---

#### Functional Information

---

Recording densities	1600 bits/inch or 6250 bits/inch
Mode of operation	Streaming and start/stop
Storage capacity	40 Mbytes with 8-Kbyte blocks, formatted
Number of tracks	9 on 0.5-inch magnetic tape
Drive interface	RDAT compatible

---

#### Ordering Information

---

TSZ07-AA	Rackmount, specify country kit
TSZ07-BA	Cabinet, 120 V
TSZ07-BB	Cabinet, 240 V
TSZ07-CA	Tabletop, specify country kit

---

#### Performance

---

Transfer rate	4 Mbytes/second
Load/unload time	55 seconds
Recording speed	100 in/second
Rewinding speed	150 seconds (with 2400 reel)

---

#### Physical Specifications

---

Tabletop	
Height	26.78 cm (10.50 inches)
Width	50.36 cm (19.75 inches)
Depth	68.85 cm (27.00 inches)
Weight	36.8 kg (81 pounds)

---

## Physical Specifications

---

### Rackmount

Height	22.32 cm (8.75 inches)
Width	43.35 cm (17.0 inches)
Depth	64.03 cm (25.5 inches)
Weight	31.8 kg (70 pounds)

### Cabinet

Height	101.0 cm (40.0 inches)
Width	56.10 cm (22.0 inches)
Depth	76.50 cm (30.0 inches)
Weight	180.1 kg (238 pounds)

---

## Maintenance

---

Cleaning cartridge interval	Every 25 hours recommended
-----------------------------	----------------------------

---

## Configuration Information

---

Form factor	5.25-inch DAT drive
Power consumption	385 W, cabinet
	355 W, tabletop
	355 W, rackmount

---

## Related Documentation

---

EK-TSZ07-IN-002	TSZ07 Installation/Owner's Manual
EK-TSZ07-TM-002	TSZ07 Technical Manual

---

## 2.2.24 TSV05 Tape Drive

The TSV05 is a magnetic streaming-tape drive that provides 40.5 Mbytes of backup data storage. The TSV05 reads or writes up to 160 Kbytes per second in standard ANSI format.

---

### Functional Information

---

Recording media	Magnetic tape, 26.7 cm (10.5 inches) reel
Tape dimensions	1.27 cm (0.5 inch) wide, 731 m (2400 feet) long
Mode of operation	Streaming
Recording method	Phase encoded (PE)
Recording density	1600 bits/inch
Number of tracks	9
Storage capacity	40 Mbytes formatted

---

### Ordering Information

---

TSV05-SE	TSV05 tape drive subsystem
----------	----------------------------

---

### Performance

---

Handling	Bidirectional reel-to-reel with compliance arm
Tape velocity	64 or 254 cm/second (25 or 100 in/second)
Maximum data transfer rate	40 or 160 Kbytes/second
Rewind time	2.8 minutes/731 m (2400 feet)

---

### Physical Specifications

---

Height	23.0 cm (8.75 inches)
Width	43 cm (17 inches)
Depth	62 cm (24.5 inches)
Weight	36 kg (80 pounds)
Form factor	10.5-in high, full rack width



---

**Related Documentation**

---

EK-TSV05-UG	TSV05 Tape Transport System User's Guide
EK-TSV05-TM	TSV05 Tape Transport Subsys Tech Manual

---

## 2.2.25 TSV05 Controller

The TSV05 tape drive controller interfaces the TSV05 tape drive to the Q22-bus.

---

**Functional Information**

---

Controller protocol	Controller unique
Supported drive	TSV05
Drives per controller	1
Drive interconnect	Direct

---

---

**Ordering Information**

---

TSV05-SB	TSV05 tape drive subsystem
TSV05-SE	TSV05 tape drive subsystem with cabinet

---

---

**Performance**

---

Buffer size	3.5 Kbytes
-------------	------------

---

---

**Configuration Information**

---

Form factor	Quad height
Power requirements	+5 Vdc, 6.5 A (typical); +12 Vdc, 0.0 A (typical)
Power consumption	32.5 W
Bus loads	2.4 ac; 1.0 dc

---

---

**Related Documentation**

---

EK-TSV05-UG	TSV05 Tape Transport System User's Guide
-------------	--

---

## 2.2.26 TU81-Plus Tape Drive

The TU81-Plus is a reel-to-reel tape drive mounted in a 101.6-cm (40-inches) cabinet. The drive supports two industry-standard recording methods: group coded recording (GCR) and phase encoded (PE).

---

### Storage Capacity

---

PE unformatted	45.3 Mbytes
PE formatted	40.0 Mbytes
GCR unformatted	177 Mbytes
GCR formatted	140 Mbytes

---

### Functional Specifications

---

Recording media	Magnetic tape
Tape dimensions	1.27 cm (0.5 inch) wide, 731 m (2400 feet) long
Mode of operation	Streaming
Recording methods	Group code recording (GCR) Phase encoded (PE)
Recording density	6250 bits/in (GCR) 1600 bits/in (PE)
Number of tracks	9

---

### Ordering Information

---

TU81E-DA	TU81-Plus tape drive, KLESI controller for 120 V
TU81E-DB	TU81-Plus tape drive, KLESI controller for 240 V

---

### Performance

---

Handling	Bidirectional reel-to-reel
Tape velocity	
High speed	190.5 cm/second (75 in/second)
Low speed	63.5 cm/second (25 in/second)

---

## **Performance**

---

### **Channel data transfer rate**

PE high speed	120 Kbytes/second
PE low speed	40 Kbytes/second
GCR high speed	469 Kbytes/second
GCR low speed	156 Kbytes/second

Rewind time (731.5 m (2400 feet) tape  
on 26.7 cm (10.5 inches) reel) 2.75 minutes maximum

---

## **Physical Specifications**

---

Height	105.8 cm (41.7 inches)
Width	54.6 cm (21.5 inches)
Depth	76.2 cm (30.0 inches)
Weight	139 kg (295 pounds)

---

## **Related Documentation**

---

EK-TU81E-UG

TU81-Plus Tape Subsystem User's Guide

---

## **2.3 Communication Options**

Your system supports the following communication options.

- CXA16 asynchronous multiplexer (16 lines)
- CXB16 asynchronous multiplexer (16 lines)
- CXY08 asynchronous multiplexer (8 lines)
- DEQRA Token Ring Q-bus adapter
- DESQA Ethernet controller
- DFA01 asynchronous controller with integral modem
- DPV11 synchronous interface
- DSRVB DECserver 200
- DSV11 synchronous controller



## Asynchronous Serial Controllers

Asynchronous serial controllers provide low-speed connections between peripheral devices and the system. Asynchronous communications between the system and the peripheral depends on recognition of a pattern of start and stop bits, not on a time interval.

## Synchronous Serial Controllers

Synchronous serial controllers provide high-speed connections between systems. Communication between synchronous devices depends on time intervals that are synchronized before transmission of data begins.

## Ethernet Controllers

Ethernet controllers connect your system to an Ethernet network. With a network connection and appropriate DECnet software, you can use all network services.

### 2.3.1 CXA16 Asynchronous Multiplexer (16 lines)

The CXA16 is an intelligent, preprogrammed serial controller that can operate in either DHV11 or DHU11 mode, depending on the setting of an on-board switch. The module contains 16 multiplexed lines.

---

#### Functional Information

---

Supported line interfaces	EIA RS-423-A/CCITT V.10
	EIA RS-232-D/CCITT V.28
	DEC-423
Split-speed operation	All lines
Flow control (XON/XOFF)	All lines
Supported data formats	16 programmable formats (each with 1 start bit)
	<ul style="list-style-type: none"><li>• 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit</li></ul>
	<ul style="list-style-type: none"><li>• 5 data bits, 0 or 1 parity bit, and 1.5 stop bits</li></ul>
	<ul style="list-style-type: none"><li>• 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits</li></ul>
	Parity, if enabled, can be either odd or even.
Modem control	None

---

---

## Ordering Information

---

CXA16-AA	CXA16 Factory-installed kit. Includes two 7.6-m (25-feet) BC16D-25 cables, two H3104 cable concentrators, and other accessories required to install the option.
CXA16-AF	Same as -AA but is field-installed.
	<ul style="list-style-type: none"><li>• BC16D-25 cable—data only, 36-conductor, terminated with 36-pin Amphenol connectors</li><li>• H3104 cable concentrator—concentrates eight BC16E cables into one BC16D cable; eight modified modular jacks and one 36-pin Amphenol connector</li></ul>
BC16E-series cable	Office cable—data only, six-conductor, terminated with modified modular plugs <ul style="list-style-type: none"><li>• BC16E-10: 3 m (10 feet)</li><li>• BC16E-25: 7.6 m (25 feet)</li><li>• BC16E-50: 15.2 m (50 feet)</li></ul>
H8572	Cable extender with modified modular jacks.
H8571-A	25-pin passive adapter <sup>1</sup>
H8571-B	9-pin passive adapter <sup>1</sup>
H3105	Active adapter. Converts EIA RS-232-D signals to DEC-423 signals.

---

## Performance

---

Transmit data transfers	Single-character transfers or up to 16-char block mode DMA transfers in DHV11 mode.  Single-character or two-character transfers, or up to 16-character block mode DMA transfers in DHU11 mode.
Receive data transfers	Single-character transfers in both DHV11 and DHU11 modes.
Transmit buffer size	One character for DHV11 mode transfers  64-character FIFO for DHU11 mode transfers  64-character FIFO for DMA transfers in DHU11 and DHV11 modes

---

<sup>1</sup>Converts a D-connector to a modified modular jack. Required for connecting terminals and printers to office cables terminated with modified modular plugs.

---

## Performance

---

Receive buffer size	256-character FIFO in DHV11 and DHU11 modes
Supported baud rates	16 programmable baud rates: 50; 75; 110; 134.5; 150; 300; 600; 1200; 1800; 2000; 2400; 4800; 7200; 9600; 19,200; 38,400 <sup>2</sup>
Throughput at maximum baud rate:	
5 data bits, 0 parity, 1 stop bit	140,000 characters/s (all lines)
7 data bits, 1 parity bit, 1 stop bit	110,000 characters/s (all lines)

---

## Configuration Information

---

Form factor	Quad height with integral, recessed cover panel
Power requirements	+5 Vdc, 1.6 A (typical); +12 Vdc, 0.20 A (typical)
Power consumption	10.4 W
Bus loads	3.0 ac; 0.5 dc
Module connectors	2 female, 36-pin Amphenol connectors

---

## Related Documentation

---

EK-CAB16-UG	CXA16/CXB16 User's Guide
EK-CAB16-TM	CXA16/CXB16 Technical Manual

---

<sup>2</sup>38,400 baud rate is not supported by Digital operating systems.

---

## 2.3.2 CXB16 Asynchronous Multiplexer (16 lines)

The CXB16 is an intelligent, preprogrammed serial controller that can operate in either DHV11 or DHU11 mode, depending on the setting of an on-board switch. The module contains 16 multiplexed lines.

---

## Functional Information

---

Supported line interfaces	EIA RS-422-A/CCITT V.11 X.27
Split-speed operation	All lines
Flow control (XON/XOFF)	All lines



---

## Functional Information

---

Supported data formats	16 programmable formats (each with 1 start bit) <ul style="list-style-type: none"><li>• 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit</li><li>• 5 data bits, 0 or 1 parity bit, and 1.5 stop bits</li><li>• 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits</li></ul> Parity, if enabled, can be either odd or even.
Modem control	None

---

## Ordering Information

---

CXB16-AA	Factory-installed module and cable kit. Includes two 7.6-m (25-foot) BC16D-25 cables, two H3104 cable concentrators, and other accessories required to install the option.
CXB16-AF	Same as -AA but is field-installed. <ul style="list-style-type: none"><li>• BC16D-25 cable—data only, 36-conductor, terminated with 36-pin Amphenol male connectors</li><li>• H3104 cable concentrator—concentrates eight BC16E cables into one BC16D cable; eight modified modular jacks and one 36-pin Amphenol female connector</li></ul>
BC16E-series cable	Office cable—data only, six-conductor, terminated with modified modular plugs <ul style="list-style-type: none"><li>• BC16E-10: 3 m (10 feet)</li><li>• BC16E-25: 7.6 m (25 feet)</li><li>• BC16E-50: 15.2 m (50 feet)</li></ul>
H8572	Cable extender. Null modem cable terminated with modified modular jacks.

---

## Performance

---

Transmit data transfers	Single-character programmed transfers or up to 16-character block mode DMA transfers in DHV11 mode.
-------------------------	---

---

## Performance

---

	Single-character or two-character programmed transfers, or up to 16-character block mode DMA transfers in DHU11 mode.
Receive data transfers	Single-character programmed transfers in both DHV11 and DHU11 modes.
Transmit buffer size	One character for programmed transfers in DHV11 mode
	64-character FIFO for programmed transfers in DHU11 mode
	64-character FIFO for DMA transfers in DHU11 and DHV11 modes
Receive buffer size	256-character FIFO in DHV11 and DHU11 modes
Supported baud rates	16 programmable baud rates: 50; 75; 110; 134.5; 150; 300; 600; 1200; 1800; 2000; 2400; 4800; 7200; 9600; 19,200; 38,400 <sup>1</sup>
Throughput at maximum baud rate:	
5 data bits, 0 parity bits, 1 stop bit	140,000 characters/second (all lines)
7 data bits, 1 parity bit, 1 stop bit	110,000 characters/second (all lines)

---

## Configuration Information

---

Form factor	Quad height with integral, recessed cover panel
Power requirements	+5 Vdc, 2.0 A (typical); +12 Vdc, 0.00 A (typical)
Power consumption	10.0 W
Bus loads	3.0 ac; 0.5 dc
Module connectors	2 female, 36-pin Amphenol connectors

---

## Related Documentation

---

EK-CAB16-UG	CXA16/CXB16 User's Guide
EK-CAB16-TM	CXA16/CXB16 Technical Manual

---

<sup>1</sup>38,400 baud rate is not supported by Digital operating systems.

---

### 2.3.3 CXY08 Asynchronous Multiplexer (8 Lines)

The CXY08 asynchronous multiplexer performs data concentration, real-time processing, and interactive terminal handling. The CXY08 can operate in either DHV11 or DHU11 mode, depending on the setting of an on-board switch. The CXY08 supports full modem control.

---

#### Functional Information

---

Supported line interfaces	EIA RS-423-A/CCITT V.10 EIA RS-232-D/CCITT V.28 DEC-423
Split-speed operation	All lines
Flow control (XON/XOFF)	All lines
Supported data formats	16 programmable formats (each with 1 start bit) <ul style="list-style-type: none"><li>• 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit</li><li>• 5 data bits, 0 or 1 parity bit, 1.5 stop bits</li><li>• 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits</li></ul> Parity, if enabled, can be either odd or even.
Modem control	Full
Supported modems	Bell models 103, 113, 212

---

#### Ordering Information

---

CXY08-AA	Factory-installed CXY08 kit. Includes two 3.7-m (12-foot) BC19N-12 cable assemblies and other accessories required to install the option.
CXY08-AF	Same as -AA but is field-installed.
<ul style="list-style-type: none"><li>• BC19N-12 cable assembly—concentrates four 11-conductor cables with 25-pin male D-connectors into one 44-conductor cable terminated by a 50-pin male CHAMP connector.)</li></ul>	



---

## Performance

---

Transmit data transfers	Single-character programmed transfers or up to 16-character block mode DMA transfers in DHV11 mode.  Single-character or two-character programmed transfers, or up to 16-character block mode DMA transfers in DHU11 mode.
Receive data transfers	Single-character programmed transfers in both DHV11 and DHU11 modes.
Transmit buffer size	One character for programmed transfers in DHV11 mode  64-character FIFO for programmed transfers in DHU11 mode  64-character FIFO for DMA transfers in DHU11 and DHV11 modes
Receive buffer size	256-character FIFO in DHV11 and DHU11 modes
Supported baud rates	16 programmable baud rates: 50; 75; 110; 134.5; 150; 300; 600; 1200; 1800; 2000; 2400; 4800; 7200; 9600; 19,200; 38,400 <sup>1</sup>
Throughput at maximum baud rate:	
5 data bits, 0 parity bits, 1 stop bit	87,771 characters/second (all lines)
7 data bits, 1 parity bit, 1 stop bit	61,440 characters/second (all lines)

---

## Configuration Information

---

Form factor	Quad height with integral, recessed cover panel
Power requirements	+5 Vdc, 1.64 A (typical); +12 Vdc, 0.395 A (typical)
Power consumption	12.94 W
Bus loads	3.0 ac; 0.5 dc
Module connectors	2 female, 50-pin CHAMP connectors

---

## Related Documentation

---

EK-CXY08-UG	CXY08 User's Guide
EK-CXY08-TM	CXY08 Technical Manual

---

<sup>1</sup>38,400 baud rate is not supported by Digital operating systems.

---

### 2.3.4 DEQRA Token Ring Q-Bus Adapter

The DEQRA Token Ring Q-bus adapter and its software, TRDRV/VMS, enable Q-bus VAX systems to connect to 4- or 16-Mbits/second Token Ring networks, and act as full function DECnet Phase IV nodes and pathworks for VMS servers.

---

#### Functional Information

---

Supported protocols	IBM-compatible Token Ring (IEEE 802.5)
Operating system supported	VMS 5.4
	DECTRN Driver VMS 1.0

---

#### Ordering Information

---

DEQRA-CA	DEQRA module, documentation, and licensed letter
BC29E-15	External console ribbon cable, 15-feet
OL-GVJAP-AA	Software license
BN26P Series	Adapter cable

---

#### Performance

---

Data transfer rate	4-Mbits and 16-Mbits
--------------------	----------------------

---

#### Diagnostic Support

---

Diagnostic support	Power-up self test
	MDM
	Installation Verification Procedure (IVP)
	DEQRA specific from host

---

#### Configuration Information

---

Form factor	Quad height
Power requirements	+5 Vdc, 4.0 A; +12 Vdc, 0.1 A
Power consumption	21.2 W

---

---

**Configuration Information**

---

Bus loads	2.2 ac; 0.5 dc
-----------	----------------

---

---

**Related Documentation**

---

EK-DEQRA-IN	DEC TRNcontroller 100 Hardware Installation and Debugging
EK-DEQRA-TM	DEC TRNcontroller 100 Hardware Description and Operation
AA-PH7NA-TE	DEC Token Ring Network Device Driver for VMS Installation
AA-PH7PA-TE	DEC Token Ring Network Device Driver for VMS Use and Programming

---

### 2.3.5 DESQA Ethernet Controller

The DESQA Ethernet controller provides a high-speed asynchronous connection between a Q22-bus system and a local area network (LAN) based on Ethernet or IEEE 802.3. The DESQA supports either standard or ThinWire Ethernet cabling.

---

**Functional Information**

---

Supported protocols	Ethernet, IEEE 802.3 Maintenance Operation Protocol (MOP)
---------------------	--

---

---

**Ordering Information**

---

DESQA-SA	Factory-installed option
DESQA-SF	Same as -SA but is field-installed
External cable (standard)	BNE3B or BNE3D
External cable (ThinWire)	BC16M

---

---

**Performance**

---

Transmit/Receive data transfers	Up to 32-byte block mode DMA
Transmit data transfers	2-Kbyte FIFO for DMA transfers

---



---

**Performance**

---

Receive data transfers	4-Kbyte FIFO for DMA transfers
Throughput at maximum rate	10 Mbits/second

---

**Configuration Information**

---

Form factor	Quad height
Power requirements	+5 Vdc, 2.4 A; +12 Vdc, 0.22 A
Power consumption	14.64 W
Bus loads	2.2 ac; 0.5 dc
Module connectors (standard)	One 15-pin D-type
Module connectors (Thinwire)	T-connector to BNC connector on DESQA

---

**Related Documentation**

---

EK-DESQA-TM	DESQA Technical Manual
-------------	------------------------

### **2.3.6 DFA01 Asynchronous Controller with Integral Modem**

The DFA01 is an asynchronous serial controller that emulates the DZQ11. It has two lines, each with a DF224-compatible integral modem.

---

**Functional Information**

---

Supported modulation protocols	Bell 103J
	Bell 212A
	CCITT V.22
	CCITT V.22-BIS
Split-speed operation	Both lines
Flow control (XON/XOFF)	No

---

## Functional Information

---

Supported data formats	8 programmable formats (each with 1 start bit) <ul style="list-style-type: none"><li>• 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit</li><li>• 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits</li></ul>
Modem control	Full

---

## Ordering Information

---

DFA01-AA	Factory-installed option
DFA01-AF	Same as -AA but is field-installed

---

## Performance

---

Transmit data transfers	Single-character programmed transfers
Receive data transfers	Single-character programmed transfers
Transmit buffer size	One character for programmed transfers
Receive buffer size	64-character FIFO
Supported baud rates	8 programmable baud rates: 50, 75, 110, 134.5, 150, 300, 1200, 2400 <sup>1</sup>
Throughput at maximum baud rate	1200 bytes/second

---

## Configuration Information

---

Form factor	Quad height with integral, flush cover panel
Power requirements	+5 Vdc, 1.97 A; +12 Vdc, 0.04 A
Power consumption	10.30 W
Bus loads	3.0 ac; 1.0 dc
Module connectors	4 TELCO: 2 modified modular jacks (MMJ) for data lines; 2 modular jacks (MJ) for voice lines

---

<sup>1</sup>The serial line is capable of baud rates up to 9600 baud. However, because the modem is restricted to speeds of 0-300, 1200, and 2400 baud, all other baud rates are considered illegal and pass meaningless data.

---

**Related Documentation**

---

EK-DFA01-UG	DFA01 Modem User's Guide
EK-DFA01-IN	DFA01 Modem Installation Guide

---

## 2.3.7 DPV11 Synchronous Controller

The DPV11 is a single-line programmable controller that provides local or remote interconnections between systems.

---

**Functional Information**

---

Supported line interfaces	EIA RS-232-C/CCITT V.28 EIA RS-423-A EIA RS-422-A
Supported protocols	DDCMP, BISYNC, and SDLC
Operating mode	Full or half-duplex
Character size	Program selectable (5-8 bits with character-oriented protocols and 108 bits with bit-oriented protocols)
Modem support	Limited
Supported modems	All Digital modems and the Bell 200 series

---

---

**Ordering Information**

---

DPV11-SA	Factory-installed option
DPV11-SF	Field-installed option

---

---

**Performance**

---

Transmit/Receive data transfers	Single-byte programmed transfer
Transmit buffer size	2 bytes
Receive buffer size	2 bytes
Data rate	56 Kbits/second



---

**Configuration Information**

---

Form factor	Dual height
Power requirements	+5 Vdc, 1.2 A (typical); +12 Vdc, 0.3 A (typical)
Power consumption	9.6 W
Bus loads	1.0 ac; 1.0 dc

---

**Related Documentation**

---

EK-DPV11-UG	DPV11 Synchronous Interface User's Guide
EK-DPV11-TM	DPV11 Technical Manual

---

### 2.3.8 DSRVB DECserver 200

The DSRVB DECserver 200 is an 8-line terminal server connecting terminals to a host computer on an Ethernet local area network. Software for the server is downloaded from a host. The server is available in two models: the modem control (MC) model an RS-232-C line interface; the data leads (DL) model has no modem control and a DEC-423 (DECconnect) line interface.

---

**Functional Information**

---

Supported line interfaces	RS-232-C (MC Model)/DEC-423 (DL Model)
Modem control	Yes (MC Model)/No (DL Model)
Protocols	Asynchronous
Supported terminal devices	VT-, LN-, LA-, and LQ-series devices

---

**Ordering Information, Hardware Only<sup>1</sup>**

---

DSRVB-AA	8-line DECserver 200/MC, RS-232-C line interface, 120 V. Includes country kit. <sup>2</sup>
DSRVB-BA	8-line DECserver 200/DL, DEC-423 (DECconnect) line interface, 120 V. Includes country kit.
DSRVB-AB	8-line DECserver 200/MC, RS-232-C line interface, 240 V. Requires country kit.

---

<sup>1</sup>See the *Networks and Communications Buyer's Guide* for appropriate software.

<sup>2</sup>Each country kit includes a power cord, hardware manual, and rack mounting brackets. See the *Networks and Communications Buyer's Guide* for available country kits.

---

**Ordering Information, Hardware Only<sup>1</sup>**

---

**DSRVB-BB**8-line DECserver 200/DL, DEC-423 (DECconnect)  
line interface, 240 V. Requires country kit.

---

**Performance**

---

**Maximum throughput**

8 lines at 19.2 Kbytes/second

---

**Physical Specifications**

---

**Height**

11.75 cm (4.63 inches)

**Width**

48.90 cm (19.25 inches)

**Depth**

32.07 cm (12.63 inches)

**Weight**

5.44 kg (12 pounds)

---

**Related Documentation**

---

**AA-HL77B-TK**

DSRVB DECserver 200 User's Guide

<sup>1</sup>See the *Networks and Communications Buyer's Guide* for appropriate software.

---

**2.3.9 DSV11 Synchronous Controller**

The DSV11 is a two-channel, high-speed, synchronous controller that interfaces Q22-bus backplanes.

---

**Functional Information**

---

**Supported line interfaces**RS-423  
RF-422  
RS-232/V.24, V.35**Supported protocols**DDCMP  
HDLC/SDLC  
BISYNC**Operating mode**

Full or half-duplex

**Modem support**

Full modem control

---

### Ordering Information

---

DSV11-SF	Factory-installed kit (first DSV11)
DSV11-SG	Field-installed kit (additional DSV11s)

---

### Performance Information

---

Transmit/Receive data transfers	DMA
Data rate, Mbits/second (maximum)	RS-232-C/V.24 = up to 20K RS-423 = 100 Kbits/second RS-422 = 256 Kbits/second V.35 = 48 Kbits/second

---

### Configuration Information

---

Form factor	Quad height
Power requirements	+5 Vdc, 5.43 A (typical); +12 Vdc, 0.69 A (typical)
Power consumption	35.43 W
Bus loads	3.9 ac; 1.0 dc

---

### Related Documentation

---

EK-DSV11-UG	DSV11-S Communications Option User Guide
EK-DSV11-TD	DSV11 Communications Option Technical Description

---

## 2.4 Real-Time Options

Real-time controllers interface devices that monitor processes in environments such as the laboratory or manufacturing. Typically, real-time controllers are parallel devices that transmit more than one bit of information simultaneously.

Your system supports the following real-time options.

- AAV11-S digital-to-analog converter
- ADQ32 analog-to-digital converter
- ADV11-S analog-to-digital converter
- AXV11 controller



- DIV32 controller
- DRQ3B parallel interface
- DRV1W parallel interface
- IBQ01 controller
- IEQ11 controller
- KWV11-S programmable real-time clock

### 2.4.1 AAV11-S Digital-to-Analog Converter

The AAV11-S is a digital-to-analog converter with DMA capability. The AAV11-S is functionally equivalent to the AAV11-D.

---

#### Functional Information

---

Circuits	Two D/A converter circuits
D/A input	12-bit digital input
Data notation	Binary input notation for unipolar output; offset binary or two's complement input notation for bipolar output.
D/A output	
Voltage	Output voltage range is jumper selectable: $\pm 10$ V, $\pm 5$ V, or 0 V to +10 V.
Control signals	4-bit digital output for control signals, such as CRT intensity, blank, unblank, and erase
Polarity	Unipolar or bipolar output

---

#### Ordering Information

---

AAV11-SA	Factory-installed option
AAV11-SF	Same as -SA but is field-installed
UDIP-BA <sup>1</sup>	Universal data interface panel mounting box
UDIP-DB	Universal data interface panel (UDIP)
UDIP-TA	Tabletop enclosure

---

<sup>1</sup>You must order the UDIP mounting box and the UDIP interface when installing a new option.

---

## Performance

---

### Analog output

Voltage	$\pm 10$ V, at 10 mA $\pm 5$ V, at 10 mA 0 V to 10 V, at 10 mA
Current	10 mA, at 10 V minimum
DC impedance	0.05 $\Omega$ typical
Linearity (0–10 V)	$\pm 1/2$ LSB; $\pm 1.2$ mV at full-scale range
Differential linearity	$\pm 1/2$ LSB
Offset error	Adjustable to 0
Offset drift	$\pm 15$ ppm/at maximum $^{\circ}\text{C}$
Gain accuracy	Adjustable to zero
Gain drift	$\pm 25$ ppm/at maximum $^{\circ}\text{C}$
Settling time	6 $\mu\text{s}$ to 0.1% for a p–p output change of 20 V

---

## Configuration Information

---

Form factor	Dual height
Power requirements	+5 Vdc, 2.10 A (typical); +12 Vdc, 0.0 A
Power consumption	10.5 W
Bus loads	2.5 ac; 0.5 dc

---

## Related Documentation

---

EK-AV11D-UG

Q-Bus DMA Analog System User's Guide

---

### 2.4.2 ADQ32 Analog-to-Digital Converter

The ADQ32 is an analog-to-digital converter with DMA capability.

---

## Functional Information

---

Input channels	32 single-ended analog input channels or 16 differential analog input channels; single-ended or differential is programmable
Programmable gain	1, 2, 4, or 8; selectable per channel
A/D output	
Resolution	12-bit output data resolution
Data notation	Straight binary (unipolar), two's complement (bipolar)
A/D conversions	Can be started by a program, a real-time clock, or an external trigger
A/D results	Can be received by a programmed I/O transfer or by servicing an interrupt request
Interrupts	Can be enabled and automatically set
Common mode rejection ratio	55 dB at maximum range

---

## Ordering Information

---

ADQ32-SA	ADQ32 factory-installed kit
ADQ32-SF	ADQ32 field-installed kit
UDIP-BA <sup>1</sup>	Universal data interface panel (UDIP) mounting box
UDIP-AA	Universal data interface panel (UDIP)
UDIP-TA	Tabletop enclosure

---

## Performance

---

Analog input	
No. of analog inputs	16 channels using differential inputs or 32 channels using single-ended inputs
Input range	0 V to +10 V (unipolar) -10 V to +10 V (bipolar)
Input impedance	10 M $\Omega$ , minimum
Input bias current	500 nA maximum ON current

---

<sup>1</sup>You must order the UDIP mounting box and the UDIP interface when installing a new option.



---

## Performance

---

Input protection	Inputs are current-limited and protected to an overvoltage of $\pm 35$ V without damage.
Common mode rejection ratio	55 dB
A/D output	
Data buffer register	16-bit read-only output register
Resolution	12 bits unipolar; 11 bits bipolar plus sign bit
Data notation	Straight binary or two's complement
Sample and hold amplifier	
Aperture uncertainty	1 nanosecond
Aperture delay	50 nanoseconds, maximum with minimum aperture enabled (clock bypass bit set)
Input noise	2 $\mu$ V p-p
A/D converter performance	
Linearity	
Differential	0.2 to 2 LSB
Integral	1.5 LSB, maximum
Scale drift	15 ppm/C typical
System throughput	
Maximum single channel sample rate	250 KHz
Maximum multichannel rate to ensure $\pm 1/2$ LSB accuracy	200 KHz

---

## Configuration Information

---

Form factor	Quad height
Power requirements	+5 Vdc, 4.45 A (typical)
	+12 Vdc, 0.0 A
Power consumption	22.25 W
Bus loads	2.5 ac
	0.5 dc

---

## Related Documentation

---

EK-153AA-UG

ADQ32 Analog-to-Digital Converter User's Guide

---

### 2.4.3 ADV11-S Analog-to-Digital Converter

The ADV11-S is an analog-to-digital converter with DMA capability. The ADV11-S is functionally equivalent to an ADV11-D.

---

#### Functional Information

---

Input channels	16 single-ended analog input channels or 8 differential analog input channels; SE/DI input is jumper-selectable.
Programmable gain	1, 2, 4, or 8
A/D output	
Resolution	12-bit output data resolution
Data notation	Binary, offset binary, or two's complement
A/D conversions	Can be started by a program, a real-time clock, or an external trigger
A/D results	Can be received by a programmed I/O transfer or by servicing an interrupt request
Interrupts	Can be enabled and automatically set by A/D DONE and/or ERROR bits
Common mode rejection ratio (gain=1)	80 dB at maximum range

---

#### Ordering Information

---

ADV11-SA	Factory-installed option
ADV11-SF	Same as -SA but is field-installed
UDIP-BA <sup>1</sup>	Universal data interface panel mounting box
UDIP-AB	Universal data interface panel for ADV11-S
UDIP-TA	Tabletop enclosure

---

<sup>1</sup>You must order the UDIP mounting box and the UDIP interface when installing a new option.

---

## Performance

---

### Analog input

Number of analog inputs	8 channels using differential inputs or 16 channels using single-ended inputs
Input range	0 V to +10 V (unipolar); -10 V to +10 V (bipolar)
Maximum input signal	$\pm 10.5$ V (signal + common mode voltage)
Input impedance	
Off channels	100 M $\Omega$ minimum, 10 pF maximum
On channels	100 M $\Omega$ minimum, 100 pF maximum
Power off	1 K $\Omega$ in series with a diode
Input bias current	$\pm 20$ nA at 25°C (77°F) maximum
Input protection	Inputs are current-limited and protected to an overvoltage of $\pm 35$ V without damage.
Common mode rejection ratio	80 dB at a range of $\pm 10$ V at 60 Hz

### A/D output

Data buffer register	16-bit read-only output register
Resolution	12 bits unipolar; 11 bits bipolar plus sign bit
Data notation	Binary, offset binary, or two's complement

### Sample and hold amplifier

Aperture uncertainty	Less than 10 nanoseconds
Aperture delay	Less than 0.5 $\mu$ s from start of conversion to signal disconnect
Front end settling	Less than 15 $\mu$ s to $\pm 0.01\%$ of full-scale value for a peak-to-peak input of 20 V
Input noise	Less than 0.2 mV rms

### A/D converter performance

Linearity	Less than $\pm 1/2$ LSB
Stability (temperature coefficient)	$\pm 30$ ppm at maximum °C (32°F)
Stability (long term)	$\pm 0.05\%$ change in 6 months
System accuracy (gain=1)	Input voltage to digitized value to within $\pm 0.03\%$



---

**Performance**

---

System throughput	25K channel samples/second
-------------------	----------------------------

---

---

**Configuration Information**

---

Form factor	Dual height
Power requirements	+5 Vdc, 2.0 A (typical); +12 Vdc, 0.0 A
Power consumption	10.0 W
Bus loads	2.3 ac; 0.5 dc

---

---

**Related Documentation**

---

EK-AV110-UG	Q-Bus DMA Analog System User's Guide
-------------	--------------------------------------

---

## 2.4.4 AXV11 Controller

The AXV11-S is an input/output circuit board for analog devices. The AXV11-S is functionally equivalent to the AXV11-C.

---

**Functional Information**

---

Input channels	16 single-ended analog input channels or 8 differential analog input channels; SE/DI jumper is field-selectable.
Programmable gain	1, 2, 4, or 8
A/D output	
Data resolution	12-bit output data resolution
Data notation	Binary, offset binary, or two's complement
Voltage	Output voltage range selection of $\pm 10$ V (bipolar) or 0 V to 10 V (unipolar)
A/D conversions	Can be started by a program, an external trigger, or a real-time clock
A/D results	Can be received by a programmed I/O transfer or by servicing an interrupt request
Common mode rejection ratio	80 dB at maximum range
D/A converters (DACs)	

---

## Functional Information

---

Number of DACs	2
Input (each DAC)	12-bit digital input
Output (each DAC)	Unipolar or bipolar output

---

## Ordering Information

---

AXV11-SA	Factory-installed option
AXV11-SF	Same as -SA but is field-installed
UDIP-BA <sup>1</sup>	Universal data interface panel mounting box
UDIP-AY	Universal data interface panel (UDIP) for AXV11-S
UDIP-TA	Tabletop enclosure

---

## Performance

---

### A/D converter performance

Linearity	To within $\pm 1/2$ LSB
Stability (temperature coefficient)	$\pm 30$ ppm at maximum °C (32°F)
Stability (long term)	$\pm 0.05\%$ change in 6 months
Conversion time	25 $\mu$ s from end of front end settling to setting the A/D DONE bit
System throughput	25K channel samples/second

### D/A converter specifications

Number of D/A converters	2
Digital input	12 bits (Binary code is used for unipolar output; offset binary or two's complement code is used for bipolar output.)
Analog output	$\pm 10$ V (bipolar) or 0 V to +10 V (unipolar)
Output current	$\pm 5$ mA maximum
Output impedance	0.1 $\Omega$
Differential linearity	To within $\pm 1/2$ LSB

---

<sup>1</sup>You must order the UDIP mounting box and the UDIP interface when installing a new option.

---

**Performance**

---

Nonlinearity	0.02% of full-scale value
Offset error	Adjustable to 0
Offset drift	$\pm 30$ ppm at maximum °C (32°F)
Gain accuracy	Adjustable to full-scale value
Gain drift	$\pm 30$ ppm at maximum °C (32°F)
Settling time	65 $\mu$ s to 0.1% for a peak-to-peak output change of 20 V
Noise	0.1% full-scale value
Capacitive load capability	0.5 $\mu$ F

---

**Configuration Information**

---

Power requirements	+5 Vdc, 2.0 A; +12 Vdc, 0.0 A
Power consumption	10.0 W
Bus loads	1.2 ac; 0.3 dc

---

**Related Documentation**

---

EK-AXVAA-UG	AXV11/KWV11 Module User's Guide
MP-O11291-00	AXV11-C Field Maintenance Print Set

## 2.4.5 DIV32 Controller

The DIV32 is a quad-height, integrated services digital network (ISDN) communication controller with connection to the Q22-bus backplane.

---

**Functional Information**

---

Supported line interfaces	RS-423 RS-422 RS-232/V.24, V.35
Supported protocols	VAX ISDN
Operating mode	Full- or half-duplex



---

**Ordering Information**

---

DIV32-SA	Factory-installed option
DIV32-SF	Same as -SA but is field-installed

---

**Performance**

---

Transmit/Receive data transfers	DMA
Data transfer rate	64 Kbits/second

---

**Configuration Information**

---

Form factor	Quad height
Power requirements	+5 Vdc, 5.5 A (typical)
Power consumption	27.5 W
Bus loads	3.9 ac; 1.0 dc

---

**Related Documentation**

---

EK-DIV32-UG	Communications Option User Guide
EK-DIV32-IN	DIV Hardware Installation Guide

---

## 2.4.6 DRQ3B Parallel Interface

The DRQ3B is a high-speed parallel interface that provides two independent 16-bit, unidirectional data channels.

---

**Functional Information**

---

Two unidirectional channels	Each 512-word FIFO
Interrupt vectors	One for both DMA channels
	One for all other interrupts

---

**Ordering Information**

---

DRQ3B-SA	Factory-installed option
DRQ3B-SF	Same as -SA but is field-installed

---

---

## Ordering Information

---

### Cables

Connects the DRQ3B to a user device or to another DRQ3B. Order two cables for each DRQ3B module.  
BC19T-25/-50: 7.6 m (25 feet)/15.2 m (50 feet)

---

## Performance

---

### Throughput rates

Burst: 500 kilowords

Block: 1.1 megawords

Extended block mode: 1.1 megawords

Height speed: 1.4 megawords

---

## Configuration Information

---

### Form factor

Quad height

### Power requirements

+ 5 Vdc, 4.5 A; +12 Vdc, 0.0 A

### Power consumption

22.5 W

### Bus loads

2.0 ac; 0.5 dc

### Module connectors

Two 50-pin female IEEE connectors

### I/O port data transceivers

Source 16 mA, sink 64 mA

---

## Related Documentation

---

### EK-O47AA-UG

DRQ3B Parallel DMA Input/Output Module  
User's Guide

---

## 2.4.7 DRV1W Parallel Interface

The DRV1W is a general-purpose, parallel interface with one 16-bit input port and one 16-bit output port. The DRV1W supports DMA. The DRV1W-S is functionally equivalent to the DRV11-WA.

---

## Functional Information

---

### Number of lines

Total: 50

16 data output lines

---

## Functional Information

---

	16 data input lines
	3 user-definable input status lines
	3 user-definable output control lines
	8 input control lines
	4 output control lines
<b>Line characteristics</b>	
Input data lines	1 TTL unit load each
Input control lines	1 TTL unit load each
Output data lines	10 TTL unit loads each
Output control lines	10 TTL unit loads each
Logic levels	High = logic 1
	Low = logic 0

---

## Ordering Information

---

DRV1W-SA	Factory-installed option
DRV1W-SF	Same as -SA but is field-installed

---

## Performance

---

Transfer mode	Up to 2-byte programmed transfers
	Up to 8-byte burst mode DMA transfers and unlimited burst mode DMA transfers (unsupported)
Data transfer rate	Up to 250,000 16-bit words/second in single-cycle mode
	Up to 500,000 16-bit words/second in burst mode

---

## Configuration Information

---

Form factor	Dual height
Power requirements	+5 Vdc, 1.8 A (typical); +12 Vdc, 0.0 A
Power consumption	9.0 W



---

**Configuration Information**

---

Bus loads	2.0 ac; 1.0 dc
Module connectors	Two 40-pin connectors

---

**Related Documentation**

---

EK-DRVWA-UG	DRV11-WA General Purpose DMA User's Guide
-------------	---

## 2.4.8 IBQ01 Controller

The IBQ01 is a DMA controller that interfaces a Q22-bus system to RS-485 industrial control and measurement devices.

---

**Functional Information**

---

Communication protocol	Modified SDLC
Supported functions	Single multidrop interconnect 250 BITBUS compatible devices

---

**Ordering Information**

---

IBQ01-SA	Factory-installed option
IBQ01-SF	Same as -SA but is field-installed
Cables	User-supplied RS-485 BITBUS standard

---

**Performance**

---

Transfer mode	Programmed I/O transfers with interrupt DMA data transfer
Data transfer rate	Up to 2.4 Mbits/second at BITBUS length of 30 m 375 Kbits/second at BITBUS length of 300 m 62.5 Kbits/second at BITBUS length of 13,200 m

---

**Configuration Information**

---

Form factor	Quad height
-------------	-------------

---

**Configuration Information**

---

Power requirements	+5 Vdc, 5.0 A; +12 Vdc, 0.3 A
Power consumption	28.6 W
Bus loads	4.6 ac; 1.0 dc

---

**Related Documentation**

---

EK-IBQ01-UG	DECscan BITBUS Controller User's Guide
EK-IBQ01-IN	DECscan BITBUS Controller Installation Manual
EK-IBQ01-TM	DECscan BITBUS Controller Technical Manual
EK-JQ52A-TN	DECscan BITBUS Controller Software Installation

---

### 2.4.9 IEQ11 Controller

The IEQ11 option is a DMA controller that interfaces a Q22-bus system to two independent instrument buses (IEC/IEEE).

---

**Functional Information**

---

Supported interfaces	IEEE-488-1978 IEC 625-1
Supported interface functions	Automatic source handshake Automatic acceptor handshake Talker and extended talker (includes serial poll) Listener and extended listener Service request Remote local Parallel poll Device clear/Device trigger Controller

---

**Ordering Information**

---

IEQ11-SA	Factory-installed option for IEC connection
IEQ11-SF	Same as -SA but is field-installed

---

**Performance**

---

Transfer mode	Programmed I/O transfers with interrupt DMA data transfers
Data transfer rate	150 Kbytes/s during a DMA block transfer

---

**Configuration Information**

---

Form factor	Quad height
Power requirements	+5 Vdc, 3.5 A (typical); +12 Vdc, 0.0 A
Power consumption	17.5 W
Bus loads	2.0 ac; 1.0 dc
Module connectors	Standard 24-pin IEEE 488 connector (IEQAA-AC) Standard 25-pin IEC 625 connector (IEQ11-AD)

---

**Related Documentation**

---

EK-IEUQ1-UG	IEU11-A/IEQ11-A User's Guide
-------------	------------------------------

---

## 2.4.10 KWV11-S Programmable Real-Time Clock

The KWV11-S is a programmable real-time clock that can be programmed to count from one to five crystal-controlled frequencies, from an external frequency or event, or from a 50-Hz or 60-Hz line frequency on the Q22-bus. The board can generate interrupts or can synchronize the processor. The KWV11-S clock is functionally equivalent to the KWV11-C.

---

**Functional Information**

---

Resolution	16 bits
Frequencies	5 internal crystal frequencies — 1 MHz, 100 kHz, 10 kHz, 1 kHz, and 100 Hz



---

## Functional Information

---

Schmitt Triggers	2, each with slope and level controls that can be used to start the clock or generate program interrupts
Input	Line frequency input from BEVNT bus (50 or 60 Hz)
Modes	4 programmable modes

---

## Ordering Information

---

KWV11-SA	Factory-installed option
KWV11-SF	Same as -SA but is field-installed
UDIP-BA <sup>1</sup>	Universal data interface panel mounting box
UDIP-KB	Universal data interface panel for KWV11-S
UDIP-TA	Tabletop enclosure

---

## Performance

---

### Clock

Crystal oscillator	10-MHz base frequency
Output ranges	1 MHz, 100 kHz, 10 kHz, 1 kHz, and 100 Hz
Oscillator accuracy	0.01%
Other sources	Line frequency or input at Schmitt Trigger

### Schmitt-Trigger input signals

Number of inputs	2
Input range	$\pm 30$ V (maximum limits)
Triggering range	-12 V to +12 V (adjustable)
Triggering slope	Positive or negative, switch-selectable
Source	User device
Response time	Depends on input waveform and amplitude; for TTL logic levels, typically 600 nanoseconds
Hysteresis	Approximately 0.5 V, positive and negative

---

<sup>1</sup>You must order the UDIP mounting box and the UDIP interface when installing a new option.

---

**Performance**

---

Characteristics	Single-ended input, 100-K $\Omega$ impedance to gnd
Clock output	
Signal	CLK OV L (clock overflow, asserted low)
Output pins	J1 pin 5 and CLK OVFL tab
Function	Time base selection from an internal crystal-controlled frequency, an input at ST1, or a line frequency at BEVNT bus line
Duration	Approximately 500 nanoseconds
Line driver	TTL-compatible, open collector circuit with a 470- $\Omega$ pull-up resistor to +5 V
Maximum source current	5 mA when output is high ( $\geq 2.4$ V), measuring from source through load to ground
Maximum sink current	8 mA when output is low ( $\leq 0.8$ V), measuring from external source voltage through load to output
Schmitt-Trigger 1 output	
Signal	ST1 OUT L (asserted low)
Output pins	J1 pin 2 and ST1 OUT tab
Function	External time base input or counter. Input frequency is a function of the input signal.
Other characteristics	Same as clock output
Schmitt-Trigger 2 output	
Signal	ST2 OUT L (asserted low)
Output pin	J1 pin 4
Function	Starts counter, sets ST2 flag, and generates an interrupt (if enabled); causes buffer preset register (BPR) to be loaded from counter.
Other characteristics	Same as clock output

---

**Configuration Information**

---

Power requirements	+5 Vdc, 2.2 A (typical); +12 Vdc, 0.013 A (typical)
Power consumption	11.156 W
Bus loads	1.0 ac; 0.3 dc

---

**Related Documentation**

---

**EK-AXVAA-UG****AXV11/KWV11 Module User's Guide**

---

## **2.5 Printer Interface**

### **2.5.1 LPV11-SA Printer Interface**

The LPV11 printer interface controls the flow of data between the Q22-bus and a line printer.

---

**Ordering Information**

---

**LPV11-SA****LPV11 controller module**

---

---

**Configuration Information**

---

**Form factor****Quad height****Power requirements****+5 Vdc, 2.8 A (typical); +12 Vdc, 0.0 A****Power consumption****14.0 W****Bus loads****1.8 ac; 0.5 dc****Module connectors****2 female, 37-pin D subminiature connectors**

---

---

**Related Documentation**

---

**EK-LPV11-OP****LPV11 Printer User's Manual**

---

## **2.6 Graphics Adapter**

### **2.6.1 VS30U Graphics Adapter**

The VS30U is a full-page, high-resolution DMA color video subsystem capable of 8-plane color video memory display. The VS30U allows field upgrade of Q-bus VAXservers to Q-bus workstations. The option includes the 8-plane color graphics module set (VCB02-J) as well as the 19-in color monitor (VR299) and a keyboard, mouse, and cable.



---

**Ordering Information**

---

VS30U	3 modules: base module and two 4-plane modules
VS30U-G3	GPX upgrade for BA213, VR299, 240 V
VS30U-G4	GPX upgrade for BA213, VR299, 240 V SH
VS30U-GA	GPX upgrade for BA213, VR299, 120 V

---

**Configuration Information**

---

Form factor	Quad height
Power requirements	Base module at +5 Vdc, 5.8 A (typical)
	Base module at +12 Vdc, 0.7 A (typical)
	4-plane module at +5 Vdc, 3.4 A (typical)

---

THE UNIVERSITY OF CHICAGO  
LIBRARY  
540 EAST 57TH STREET  
CHICAGO, ILL. 60637

RECEIVED  
JAN 10 1964  
FROM THE  
LIBRARY OF THE  
UNIVERSITY OF CHICAGO  
540 EAST 57TH STREET  
CHICAGO, ILL. 60637

## Chapter 3

# System Expansion

---

This chapter provides guidelines on how to expand your system.

### 3.1 Planning System Expansion

You must consider the following when you decide to expand your system.

- Can your system accommodate additional supported options?

You determine that by filling in a worksheet (Section 3.2) with the options currently installed in your system and those you wish to add.

- If your existing system cannot accommodate a particular set of supported options, you might wish to add one of the following expanders, to enable support for the RA-series or RF-series ISEs.

Expander Name	Additional Q22-Bus Slots	Additional Storage Capacity
B213F	10	Up to three RF-series ISEs, and one TK-series tape drive, or four ISE and no tape.
R215F	0	Up to three RF-series ISEs.
B400X	10	Up to four RF-series ISEs, or three ISEs and one TK-series, TLZ04, or TF-series tape drive.
R400X	0	Up to seven RF-series ISEs <sup>1</sup> , or six RF-series ISEs with room for one TLZ04 or TF85 tape drive.
SF100	0	One TF857 magazine tape subsystem and up to four RF72 or RF73 ISEs.
SF200	0	Up to two TF857 magazine tape subsystems, and two to 24 RF72 or RF73 ISEs.

---

<sup>1</sup>RF35 may contain two ISEs.

---

This chapter does not describe how to configure new options or how to install them in your system. Configuring an option involves assigning a control and status register (CSR) address and an interrupt vector. This is usually done



by means of switches or jumpers on the options themselves. Digital service representatives configure the options when they install them. Your Digital service representative also determines the proper placement of options within your system, according to specific guidelines.

## **3.2 Completing the System Configuration Worksheet**

To determine what options you can add to your system, you must list the options currently installed and their power requirements on the configuration worksheet provided on the next page.

The worksheet is for the BA440 enclosure. All backplane slots and mass storage devices are powered by the H7874 power supply.

Use the worksheets as follows.

1. In the Module column, list all options and mass storage devices currently installed in your system, except the controller for the tape drive. The KA6nn processor module has already been entered.

Use the label on the cover panel of each slot to identify the module installed in that slot.

2. List each embedded storage device.
3. List the options and mass storage devices you wish to add to your system.
4. If the system includes a TK70 tape drive, list the TQK70 controller last.
5. Fill in the power requirements for each module and each mass storage device. The power requirements for the more common options are listed in Table 3-1; refer to the option descriptions in Chapter 2 for the power requirements of additional options.
6. Add each column and make sure the totals do not exceed the specified limit. As long as the figures are within range, you can probably install the new option(s).

Slot	Module	Current (Amps) <sup>1</sup>				Power (Watts)	Bus Load	
		+5 Vdc	+12 Vdc	+3.3 Vdc	-12 Vdc		AC	DC
MEM 1								
MEM 2								
MEM 3								
MEM 4								
CPU 2	L4002-nA <sup>3</sup>	4.8	1.6	3.2	0.0	53.8	4.0	1.0
Q-bus 1								
Q-bus 2								
Q-bus 3								
Q-bus 4								
Q-bus 5								
Q-bus 6								
Q-bus 7								
<b>Mass Storage:</b>								
Tape							—	—
1								
2								
3								
4								
Total these columns:								
Must not exceed:		60.0 A	22.0 A	15.0 A	3.0 A	584.0 W	31	20

1. Total output power from +3.3 Vdc and +5 Vdc must not exceed 330 watts.

2. Power requirements in this line include CPU module, H3604 console module, and backplane terminator combined.

3. KA680(L4002-BA) or KA690(L4002-AA)

MLO-005361

**NOTE:** *The worksheets are only guides. Confirm your plan with your Digital sales representative. While certain configurations may be possible, they may not be recommended due to excessive loads on the system or difficulties in arranging bus and cable access to all devices.*



**Table 3-1: Power Requirements**

Option	Module	Current (Amps) Max		Power Max Watts	Bus Loads		Operation Mode
		+5 V	+12 V		AC	DC	
AAV11-SA	A1009-PA	2.10	0.00	10.50	2.5	0.5	
ADQ32-SA	A030	4.45	0.00	22.25	2.5	0.5	
ADV11-SA	A1008-PA	2.00	0.00	10.00	2.3	0.5	
AXV11-SA	A026-PA	2.00	0.00	10.00	1.2	0.3	
CXA16-AA	M3118-YA	1.60	0.20	10.40	3.0	0.5	
CXB16-AA	M3118-YB	2.00	0.00	10.00	3.3	0.5	
CKY08-AA	M3119-YA	1.64	0.395	12.94	3.0	0.5	
DESQA-SA	M3127-PA	2.40	0.22	14.64	3.3	0.5	
DFA01-AA	M3121-PA	1.97	0.04	10.30	3.0	1.0	
DIV32-SA	M7571-PA	5.5	0.00	35.4	3.5	1.0	
DFV11-SA	M8020-PA	1.20	0.30	9.60	1.0	1.0	
DRQ3B-SA	M7658-PA	4.50	0.00	22.50	2.0	0.5	
DRV1J-SA	M8049-PA	1.80	0.00	9.00	2.0	1.0	
DRV1W-SA	M7651-PA	1.80	0.00	9.00	2.0	1.0	
DSV11-SA	M3108	5.43	0.69	35.43	3.9	1.0	
H3804 <sup>1</sup>	-	1.70	0.50	14.50	-	-	
IBQ01-SA	M3125-PA	5.00	0.30	28.60	4.6	1.0	
IEQ11-SA	M8634-PA	3.50	0.00	17.50	2.0	1.0	
KA690-AA	L4002-BA	4.8	1.6	53.8	4.0	1.0	
KA690-AA	L4002-BA	4.8	1.6	53.8	4.0	1.0	
KDA50-SE	M7164	6.93	0.00	34.65	3.0	0.5	
—	M7165	6.57	0.03	33.21	-	-	
KFQSA-SA/SE	M7769	5.50	0.00	27.50	4.4	0.5	
KLES1-SA/SF	M7740-PA	4.00	0.00	20.00	0.5	1.0	

<sup>1</sup>Also include -12 Vdc @ 0.25 A, 3 W.



Table 3-1 (Cont.): Power Requirements

Option	Module	Current (Amps) Max		Power Max	Bus Loads		Operation Mode
		+5 V	+12 V		AC	DC	
KRQ60-SA/SF	M7552	2.70	0.00	13.50	2.7	1.0	
KWV11-SA	M4002-PA	2.20	0.013	11.156	1.0	0.3	
KXJ11-SF	M7616	6.0	0.4	46.8	2.0	1.0	
KZQSA-SA	M5976	5.4	0.0	27.0	4.4	0.5	
LPV11-SA	M8086-PA	2.80	0.00	14.00	1.8	0.5	
M9404-PA	M9404	-	0.00	0.0	-	-	
M9405-PA	M9405	-	0.00	0.0	-	-	
MRV11-D	M8578	1.60 <sup>2</sup>	0.00	8.00	3.0	0.5	
MS690-BA	L4004-BA	5.03	0.00	26.5	-	-	
MS690-CA	L4004-CA	4.2	0.00	21.0	-	-	
MS690-DA	L4004-DA	6.4	0.00	32.0	-	-	
RF31E-AA/AF	-	1.20	3.03	42.4	N/A	N/A	peak @spin-up
RF35E-AA/AF	-	0.71	0.85	13.7	N/A	N/A	
RF352-AA/AF	-	0.85	2.55	34.9	N/A	N/A	peak @spin-up
RF71E-AA/AF	-	1.25	1.64	25.93	N/A	N/A	
RF72E-AA	-	1.38	4.68	63.0	N/A	N/A	peak @spin-up
RF73E-AA	-	1.20	5.00	66.0	N/A	N/A	peak @spin-up
TF65E-JA/JF	-	1.50	2.40	36.30	N/A	N/A	
TK50E-AA	-	1.50	2.40	36.30	N/A	N/A	
TK70E-AA	-	1.50	2.40	36.30	N/A	N/A	
TLZ04-JA/JF	-	1.5	2.4	36.3	N/A	N/A	
TQK50-SA/SF	M7546	2.9	0.00	14.5	2.8	0.5	
TQK70-SA/SF	M7550	3.50	0.00	17.50	4.3	0.5	
TSV05-SA	M7530	6.50	0.00	32.50	1.5	1.0	
VCB02-A	M7615	4.60	0.10	24.2	3.5	1.0	

<sup>2</sup>Value is for the unpopulated module only.

**Table 3-1 (Cont.): Power Requirements**

Option	Module	Current (Amps) Max		Power Max	Bus Loads		Operation Mode
		+5 V	+12 V	Watts	AC	DC	
VCB02-B	M7168-00 M7169	8.85	0.47	49.89	3.5	1.0	
VCB02-C	(2) M7168-00 M7169	12.0	0.47	65.64	3.5	1.0	

# Index

---

## A

---

Asynchronous serial controllers  
description of, 2-36

## B

---

BA440 enclosure, 1-1  
Base system  
description of, 1-1  
Break Enable/Disable switch  
description of enable setting, 1-3

## C

---

Communication options  
supported, list, 2-35  
Console commands  
qualifier and argument  
conventions in Console  
I/O mode, 1-5  
Console I/O mode  
and examples of SET and SHOW  
commands, 1-8  
console commands, 1-5  
description of, 1-3  
Console program, 1-2  
and power-up mode, 1-3  
entering Console I/O mode, 1-3  
Control and status register (CSR)  
assigning, 3-1  
description of, 2-1  
CSR  
*See* Control and status register

## D

---

Device abbreviations, 1-10  
DHU11 mode  
and CXA16 support, 2-36  
and CXB16 support, 2-38  
DHV11 mode  
and CXA16 support, 2-36  
and CXB16 support, 2-38  
Digital Storage Systems Interconnect  
*See* DSSI  
DSSI  
description of, 1-11

## E

---

Expanding system, 3-1

## F

---

Firmware  
system control of, 1-3

## I

---

Integrated storage element (ISE)  
and support on DSSI bus, 1-11  
RF-series, description of, 2-13,  
2-14, 2-17, 2-18  
RF-series, description of RF35,  
2-15  
RF73, description of, 2-19  
Interrupt vector  
description of, 2-1

## K

---

KA675-AA modules  
system names, 1-12



KA680-AA modules  
system names, 1-15, 1-19

VMB  
description of, 1-2

## **M**

---

Mass storage controllers

See Controllers

Modules

KA6nn-AA CPU, location, 1-1

## **N**

---

Network controllers

description of, 2-36

## **P**

---

Power supply

minimum load, 3-6

Power-up self-tests

description of, 1-2

## **R**

---

Real-time options

supported, list of, 2-50

## **S**

---

Self-tests

See Power-up self-tests

SET BOOT command, 1-10

SET command

description of, 1-8

SET LANGUAGE command, 1-10

SHOW command

description of, 1-8

SHOW DEVICE display, 1-9

SHOW ETHERNET display, 1-10

SHOW LANGUAGE display, 1-10

SHOW QBUS display, 1-8

Synchronous serial controllers

description of, 2-36

## **V**

---